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 Barron County, Wisconsin

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.

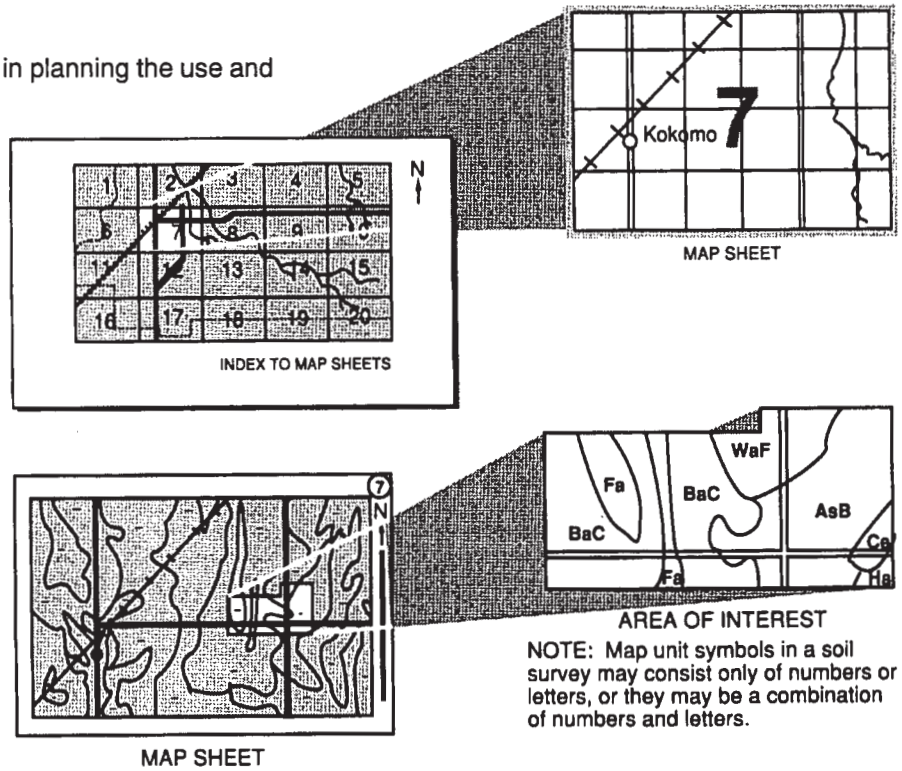
Detailed Soil Maps

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 1991. Soil names and descriptions were approved in 1992. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. 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 Barron County Land Conservation Committee, which helped 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: An area of farmland in Doyle Township. The wooded areas in the background are the Blue Hills, a local landmark representing the highest elevation in Barron County.

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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Issued 2001

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, 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.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are only moderately deep 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 or from private soil science consultants.

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State Conservationist
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Soil Survey of
Barron County, Wisconsin

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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

BARRON COUNTY is in northwestern Wisconsin (fig. 1). It is square and measures 30 miles on a side. It has a total area of about 569,197 acres, or 889.4 square miles. In 1987, the population of the county was estimated at 40,732 (Barron County Land Conservation Department, 1988). The city of Barron, in the central part of the county at the junction of the Yellow River and Quarderer Creek, is the county seat.

Barron County is predominantly rural; approximately 60 percent of the area is farmland. Major agricultural products include dairy products, turkeys, and vegetables. Barron County is among the leading Wisconsin counties in dairying. Attractive physical features in Barron County form the basis for a wide variety of recreational developments and activities.

A soil survey of Barron County was made between 1940 and 1947 by the Division of Soil Survey of the U.S. Department of Agriculture, Bureau of Plant Industry, and by the Soil Survey Division of the Wisconsin Geological and Natural History Survey and the Wisconsin Agricultural Experiment Station of the State of Wisconsin. The survey was published in 1958 (Robinson and Vessel, 1958). The present survey updates the earlier survey. It provides more interpretive information and has larger maps, which show the soils in greater detail.

General Nature of the County

This section provides general information regarding some of the physical and cultural characteristics of the county. It describes history and development; climate; physiography, relief, and drainage; water supply; and transportation facilities and industry.

History and Development

The earliest residents of the survey area who left definite evidence of their occupancy were the American Indian mound builders. The county contains about 250 mounds. The first Europeans to traverse the area were Pierre Radisson and Chourat des Grosseillier in 1664 (West Central Wisconsin Regional Planning Commission, 1989).

The survey area was claimed by the United States in 1787 as part of the Northwest Territory, and it later became part of the territory of Wisconsin. The area was part of Crawford County until 1840. Between 1840 and 1869, the area was part of St. Croix County, Chippewa County, Polk County, and Dallas County. In 1869, the name was changed to Barron County in honor of Henry D. Barron, a prominent Wisconsin pioneer, editor, senator, and jurist. The present county boundaries were set in 1874. The first county seat was

Figure 1.—Location of Barron County in Wisconsin.

located near the city of Barron in 1873. The county seat was later moved to Rice Lake and then, in 1874, to Barron.

Lumbering activities were started in the county in 1848. The first logging camp was established at Prairie Farm at about the same time the first farm settlement in the county was established, north of what is now the village of Prairie Farm. Soon after, a settlement was established in the vicinity of present-day Dallas.

Logging supported the county until about 1895, when farming became more important. Agriculture, dairying, and the development of creameries became the mainstay of the county's economy. The turkey industry, tourism, and small manufacturing also contribute to the local economy.

Climate

In Barron County, winters are very cold and the short summers are fairly warm. Crops commonly grown are corn, forage, small grain, and adapted vegetables. Precipitation is fairly well distributed throughout the year but reaches a slight peak in the 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 Cumberland in the period 1951 to 1988. 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 14 degrees F and the average daily minimum temperature is 4 degrees. The lowest temperature on record, which occurred on January 9, 1977, is -40 degrees. In summer, the average temperature is 69 degrees and the average daily maximum temperature is 80 degrees. The highest recorded temperature, which occurred on July 15, 1988, is 103 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 33 inches. Of this, about 24 inches, or about 73 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 19 inches. The heaviest 1-day rainfall during the period of record was 6.4 inches on August 28, 1960. Thunderstorms occur on about 38 days each year.

The average seasonal snowfall is about 52 inches. The greatest snow depth at any one time during the period of record was 37 inches. On the average, 68 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

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

Physiography, Relief, and Drainage

Barron County consists of a fairly level to sloping central plain rimmed on the south by dissected sandstone, on the west and north by moraines, and on the east by a range of quartzite ridges (Johnson, 1986). The county is in three different physiographic provinces of Wisconsin. Most of the county lies in the Central Plain province, which is characterized by a combination of smooth uplands, rolling till plains, and flat outwash plains. The southwestern hills are part of the Western Upland province. The quartzite ridge in

the eastern part of the county, known as the Blue Hills, is part of the Northern Highlands province.

Other prominent landscape features include the extensive ground moraine and the outwash plains. The northern part of Barron County, covered by the youngest glacial deposits, has a characteristic glacial landscape consisting of high-relief, hummocky topography with scattered flat ice-walled lake plains. The elevation of the county ranges from 995 to 1,630 feet above sea level. The highest point is in the Blue Hills in the southeastern part of Doyle Township.

Most of Barron County is in the Chippewa River Basin. A small area along the western boundary of the county is in the St. Croix River Basin. Most of the county is drained by the Red Cedar River, a major tributary of the Chippewa River. The county is subdivided into five major watersheds—a portion of the St. Croix River Basin and the Hay River, Yellow River, Red Cedar River, and Lake Chetek/Chetek River Basins. Small streams in these watersheds include the Brill River, Pokegama Creek, Moose Ear Creek, Pine Creek, the Vermillion River, Bear Creek, Moon Creek, and Turtle Creek.

Water Supply

Barron County has about 20,628 acres of surface water. Lakes account for about 94 percent of the total area of surface water. These lakes provide the basis for a growing recreational industry. Red Cedar Lake is the largest single body of water in the county. The surface water is generally soft, and most streams and lakes are relatively unpolluted.

The overall quality of the ground water in Barron County is good, and the water is suitable for most uses. Ground water is obtained primarily from sand and gravel aquifers and from Cambrian sandstone. Hardness of water can be a minor problem in some areas. The ground water in Barron County is dominantly moderately hard.

Large amounts of water are used for agricultural irrigation in Barron County. The potential yield from sand and gravel aquifers is high. Yields of 500 to 1,000 gallons per minute are common. The sandstone aquifer provides reliable water supplies for municipal, industrial, domestic, and irrigation uses. Yields of 100 to 500 gallons per minute are common. Yields from the glacial deposits in areas of ground moraine or end moraine in the western and northern parts of the county are commonly about 100 gallons per minute. In the Precambrian aquifer, consisting of Barron Quartzite in the eastern part of the county, the yields are commonly about 10 gallons per minute.

Transportation Facilities and Industry

The principal north-south roads in the county are U.S. Highways 53 and 63 and State Highway 25. The main east-west roads are U.S. Highway 8 and State Highway 48. Rail service is provided by two railroads. Barron County has four publicly owned airports. These airports are near Cumberland, Barron, Rice Lake, and Chetek.

The main agricultural enterprise in the county is dairying. Most of the milk is used in making cheese or is sold on the grade-A fluid milk market. Barron County ranks first among Wisconsin counties in the number of turkeys raised. A large turkey-processing plant is in Barron.

Commercial mineral resources in Barron County include sand and gravel and crushed quartzite. Saw logs and pulpwood are important forest products. Several wood-working plants are in the county. Most of the pulpwood is used outside the county.

Barron County has several light manufacturing industries. Some of the manufactured products are computer components, molded plastics, die cast parts, hardware, abrasive products, window and door screens, cabinets, bulk excelsior, scales and parts, truck and bus bodies, machine tools and accessories, and electronic devices.

Barron County has many recreational facilities and resources, ranging from hunting and fishing areas to snowmobiling, hiking, and cycling trails. The county has excellent public and private camping facilities near the many lakes and streams and in the county forest. Barron County offers excellent canoeing and boating opportunities and has several golf courses and ski areas.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; 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 and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area 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-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, 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 and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in the adjacent survey areas (Chippewa and Polk Counties). Differences are mainly the result of variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. These areas are called soil associations. Each association on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The components of one association can occur in another but in a different pattern.

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

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

1. Arland-Hayriver-Freeon Association

Moderately deep, deep, or very deep, gently sloping to very steep, well drained and moderately well drained, loamy and silty soils underlain by sandstone; on uplands

This association makes up about 14 percent of the county. It is about 35 percent Arland and similar soils, 25 percent Hayriver soils, 9 percent Freeon and similar soils, and 31 percent soils of minor extent (fig. 2).

Arland soils are moderately deep, gently sloping to steep, and well drained. They are on knolls and ridges in the uplands. Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The next layer is brown and reddish brown sandy loam about 13 inches thick. The subsoil is reddish brown, friable sandy loam about 13 inches thick. Below this to a depth of 60 inches or more is sandstone.

Hayriver soils are moderately deep, gently sloping to very steep, and well drained. They are on ridgetops and side slopes in the uplands. Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is brown fine sandy loam about 5 inches thick. The subsoil is dark yellowish brown, friable fine sandy loam about 17 inches thick. Below this to a depth of 60 inches or more is fine grained glauconitic sandstone.

Freeon soils are gently sloping and sloping and are moderately well drained. They are deep or very deep to dense till. They are in plane areas and on side slopes and knolls in the uplands. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next 12 inches is brown and dark yellowish brown, mottled silt loam. Below this is about 20 inches of dark brown and brown, mottled sandy loam. The subsoil is dark reddish brown, mottled, friable sandy loam about 46 inches thick. The substratum to a depth of 99 inches or more is reddish brown, firm sandy loam.

Of minor extent in this association are Anigon, Chetek, Dobie, Doritty, Plainbo, Quarderer, Rosholt, Twinmound, Vancecreek, and Wickware soils. The well drained Anigon soils formed mostly in loess or silty alluvium and in loamy alluvium underlain by sandy outwash. They are in plane areas and on side slopes. The somewhat excessively drained Chetek soils formed in loamy alluvium and in the underlying sandy outwash. They are in plane areas and on side slopes. The well drained Dobie soils formed in loess and loamy residuum underlain by sandstone. They are on ridgetops and side slopes. The moderately well drained Doritty soils formed in silty colluvium. They are on footslopes. The excessively drained Plainbo soils formed in sandy eolian or alluvial deposits over sandstone. They are on outwash plains, stream terraces, and footslopes and side slopes of adjacent uplands. The moderately well drained Quarderer soils formed in silty alluvium. They are in drainageways. The well drained Rosholt soils formed in loamy alluvium and sandy outwash. They are on outwash plains and stream terraces. The excessively drained Twinmound soils formed in siliceous sandy residuum derived from the underlying sandstone. They are on side slopes. The poorly drained Vancecreek soils formed in silty alluvium. They are on flood plains. The well drained

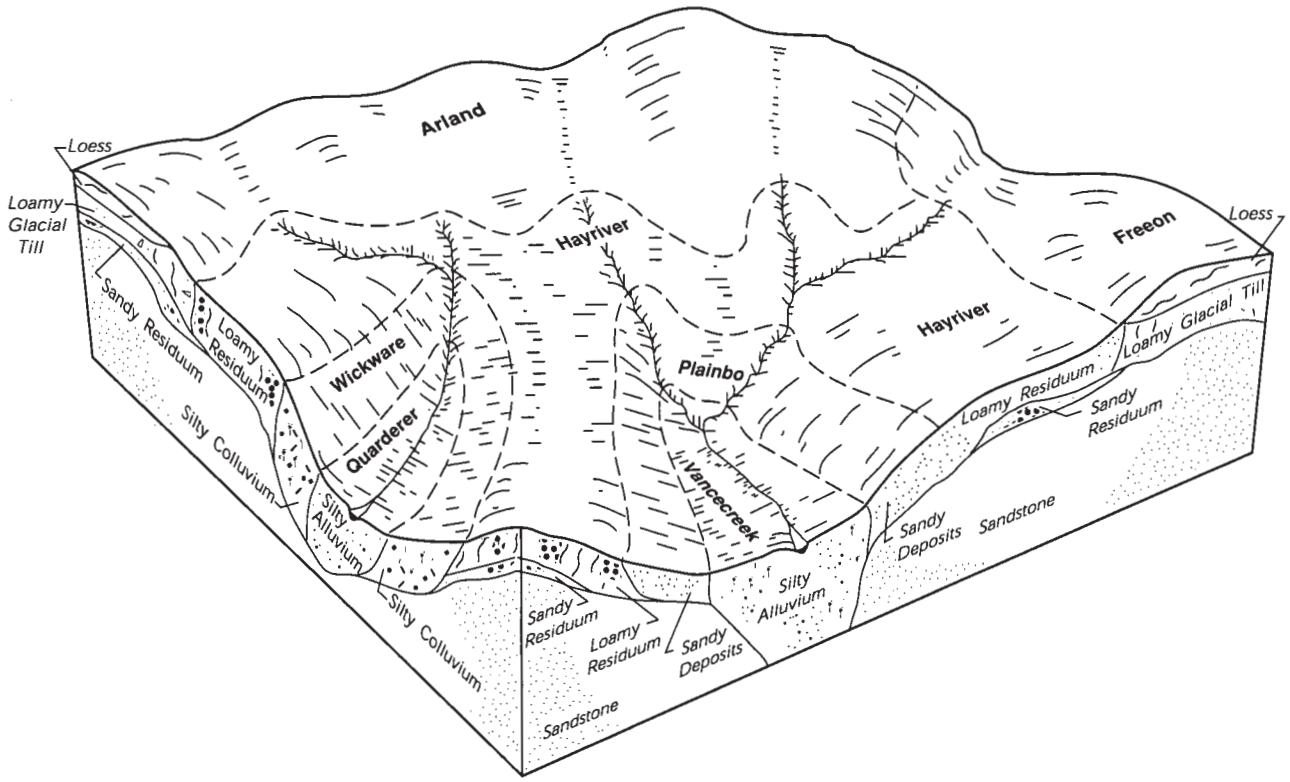

Figure 2.—Typical pattern of soils and parent material in the Arland-Hayriver-Freeon association.

Wickware soils formed in silty colluvium. They are on footslopes and side slopes.

Most areas of the less sloping soils in this association are used as cropland or pasture. Many areas are wooded. The less sloping major soils are suited to cultivated crops, but water erosion is a hazard. Soil blowing and droughtiness are additional concerns in areas of the Arland and Hayriver soils. All of the major soils are suited to trees.

The nearly level and gently sloping areas of the Arland and Hayriver soils are suited to dwellings. Because of wetness, the Freeon soils are only moderately suited to dwellings without basements and are poorly suited to dwellings with basements. The Arland and Hayriver soils are poorly suited to septic tank absorption fields because of the thin soil layer over sandstone and the moderately rapid or rapid permeability in the substratum. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water. The Freeon soils are poorly suited to septic tank absorption fields because of the wetness and the slow or moderately slow permeability in the lower part of the subsoil and the very slow permeability in the substratum.

2. Chetek-Rosholt-Menahga Association

Very deep, nearly level to steep, excessively drained to well drained, loamy and sandy soils on outwash plains and stream terraces

This association makes up about 18 percent of the county. It is about 35 percent Chetek and similar soils, 23 percent Rosholt and similar soils, 16 percent Menahga and similar soils, and 26 percent soils of minor extent.

Chetek soils are somewhat excessively drained. They are in plane and slightly convex areas and on side slopes on outwash plains and stream terraces. Typically, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is about 10 inches thick. It is dark brown, friable sandy loam in the upper part and reddish brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of 60

inches or more is yellowish brown, stratified gravelly sand and sand.

Rosholt soils are well drained. They are in plane and slightly convex areas and on side slopes of outwash plains and stream terraces. Typically, the surface layer is dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The next layer is brown and dark brown loam about 9 inches thick. The subsoil is about 16 inches thick. It is dark brown, friable loam in the upper part; reddish brown, friable sandy loam in the next part; and dark brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is strong brown, stratified very gravelly sand and gravelly sand.

Menahga soils are excessively drained. They are in plane and slightly convex areas and on side slopes of outwash plains. Typically, the surface layer is very dark grayish brown loamy sand about 12 inches thick. The subsoil is dark yellowish brown, dark brown, and strong brown, very friable sand about 20 inches thick. The substratum to a depth of 60 inches or more is yellowish brown sand.

Of minor extent in this association are Anigon, Brill, Freeon, Haugen, and Oesterle soils. The well drained Anigon soils formed in loess or silty alluvium and in loamy alluvium underlain by sandy alluvium. They are on flats and side slopes. The moderately well drained Brill soils formed in loess or silty alluvium underlain by stratified sandy outwash. They are on flats and footslopes. The moderately well drained Freeon soils formed in loess or other silty material and in the underlying dense loamy till. They are in plane or slightly concave areas. The moderately well drained Haugen soils formed in loamy glacial mudflow sediment and in the underlying dense loamy till. They are on ridgetops and side slopes. The somewhat poorly drained Oesterle soils formed in loamy alluvium and in the underlying sandy outwash. They are in drainageways.

Most areas of the less sloping Chetek and Rosholt soils are used as cropland or pasture. Most areas of the Menahga soils are used as cropland or woodland. The less sloping major soils are suited to cultivated crops, but water erosion and droughtiness are hazards. The Chetek and Menahga soils are also subject to soil blowing. The major soils are suited to trees.

The less sloping areas of the major soils are suited to dwellings. The effluent from septic tank absorption fields will drain satisfactorily, but the pollution of ground water is a concern because of the rapid or very rapid permeability in the substratum.

3. Anigon-Rosholt-Chetek Association

Very deep, nearly level to steep, well drained and somewhat excessively drained, silty and loamy soils on outwash plains and stream terraces

This association makes up about 18 percent of the county. It is about 52 percent Anigon and similar soils, 14 percent Rosholt and similar soils, 13 percent Chetek and similar soils, and 21 percent soils of minor extent (fig. 3).

Anigon soils are nearly level to sloping and are well drained. They are in plane and slightly convex areas and on convex side slopes of outwash plains. Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsurface layer is pale brown silt loam about 2 inches thick. The next layer is pale brown, brown, and dark brown silt loam about 11 inches thick. The subsoil is about 19 inches thick. It is dark brown, friable silt loam in the upper part and dark brown, friable loam in the lower part. The substratum to a depth of 60 inches or more is strong brown, stratified very gravelly sand and sand.

Rosholt soils are nearly level to steep and are well drained. They are in plane and slightly convex areas and on side slopes of outwash plains and stream terraces. Typically, the surface layer is dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The next layer is brown and dark brown loam about 9 inches thick. The subsoil is about 16 inches thick. It is dark brown, friable loam in the upper part; reddish brown, friable sandy loam in the next part; and dark brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is strong brown, stratified very gravelly sand and gravelly sand.

Chetek soils are nearly level to steep and are somewhat excessively drained. They are in plane and slightly convex areas and on side slopes on outwash plains and stream terraces. Typically, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is about 10 inches thick. It is dark brown, friable sandy loam in the upper part and reddish brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, stratified gravelly sand and sand.

Of minor extent in this association are Fordum, Poskin, Rib, and Seelyeville soils. The poorly drained

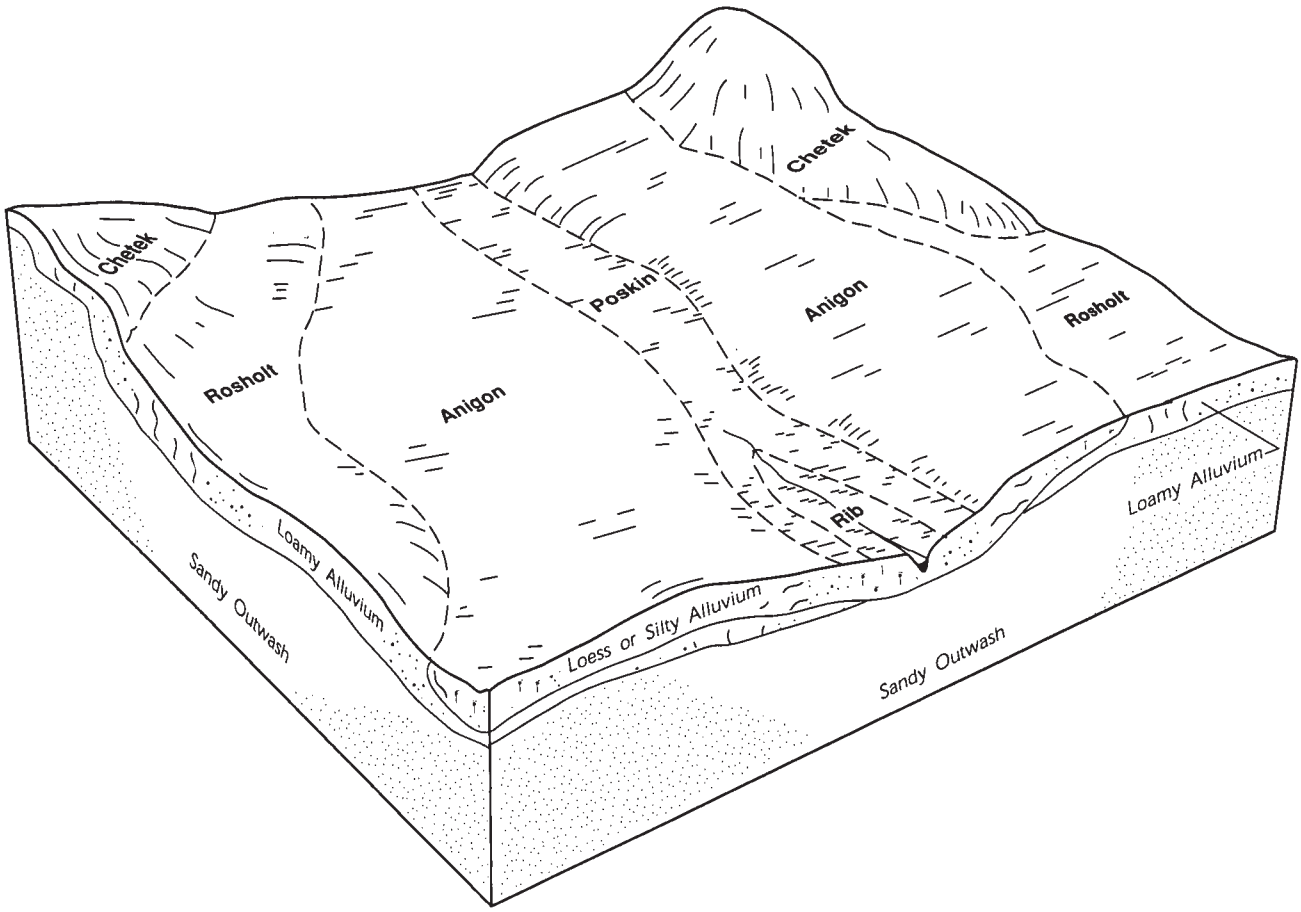

Figure 3.—Typical pattern of soils and parent material in the Anigon-Rosholt-Chetek association.

Fordum soils formed in silty and loamy alluvium underlain by sandy alluvium. They are in plane or slightly concave areas on flood plains. The somewhat poorly drained Poskin soils formed in loess or silty alluvium underlain by stratified sandy outwash. They are in shallow depressions and drainageways. The poorly drained Rib soils formed in silty alluvium underlain by sandy outwash. They are in depressions and drainageways. The very poorly drained Seelyeville soils formed in herbaceous organic material. They are in depressions.

Most areas of the less sloping soils in this association are used as cropland or pasture. The less sloping major soils are suited to cultivated crops, but water erosion and droughtiness are hazards. The Chetek soils are also subject to soil blowing. The major soils are suited to trees.

The less sloping areas of the major soils are suited to dwellings. The effluent from septic tank absorption fields will drain satisfactorily, but the pollution of ground water is a concern because of the rapid or very rapid permeability in the substratum.

4. Haugen-Greenwood-Amery Association

Deep or very deep, nearly level to very steep, very poorly drained, moderately well drained, and well drained, loamy soils and organic soils; on moraines

This association makes up about 11 percent of the county. It is about 40 percent Haugen soils, 26 percent Greenwood and similar soils, 9 percent Amery soils, and 25 percent soils of minor extent (fig. 4).

Haugen soils are gently sloping to moderately steep and are moderately well drained. They are deep or very deep to dense till. They are on ridgetops and side slopes on moraines. Typically, the surface layer is very dark brown sandy loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown,

friable sandy loam about 19 inches thick. The next 26 inches is dark reddish brown and reddish brown, mottled, friable sandy loam. The lower part of the subsoil is about 30 inches thick. It is reddish brown, friable gravelly loamy sand in the upper part and dark reddish brown, firm sandy loam in the lower part. The substratum to a depth of about 88 inches is reddish brown, firm sandy loam.

Greenwood soils are very deep, nearly level, and very poorly drained. They are in depressions. Typically, they are black and very dark brown muck to a depth of at least 60 inches.

Amery soils are moderately steep to very steep and are well drained. They are deep or very deep to dense till. They are on ridgetops, side slopes, and knolls on moraines. Typically, the surface layer is black sandy loam about 3 inches thick. The upper part of the subsoil is yellowish brown, friable sandy loam about 19 inches thick. The next 19 inches is brown, dark brown, and reddish brown, friable sandy loam. The lower part of the subsoil is reddish brown, friable gravelly sandy loam and sandy loam about 30 inches thick. The substratum to a depth of 80 inches or more is dark reddish brown sandy loam.

Of minor extent in this association are Adolph, Chetek, Crystal Lake, and Freeon soils. The very poorly drained Adolph soils formed in silty alluvium and in the underlying dense sandy loam glacial till. They are in depressions and drainageways. The well drained Chetek soils formed in loamy alluvium and in the underlying sandy outwash. They are in plane or slightly convex areas and on side slopes. The moderately well drained Crystal Lake soils formed in silty lacustrine deposits. They are in plane and slightly convex areas. The moderately well drained Freeon soils formed in loess or other silty deposits and in the underlying dense loamy glacial till. They are in slightly concave areas and on side slopes and knolls.

Most areas of the Haugen and Amery soils are wooded. Most areas of the Greenwood soils support wetland grasses, shrubs, and trees. The Haugen soils and the less sloping areas of the Amery soils are used as cropland or pasture. The less sloping areas of the Haugen soils are suited to cultivated crops, but water

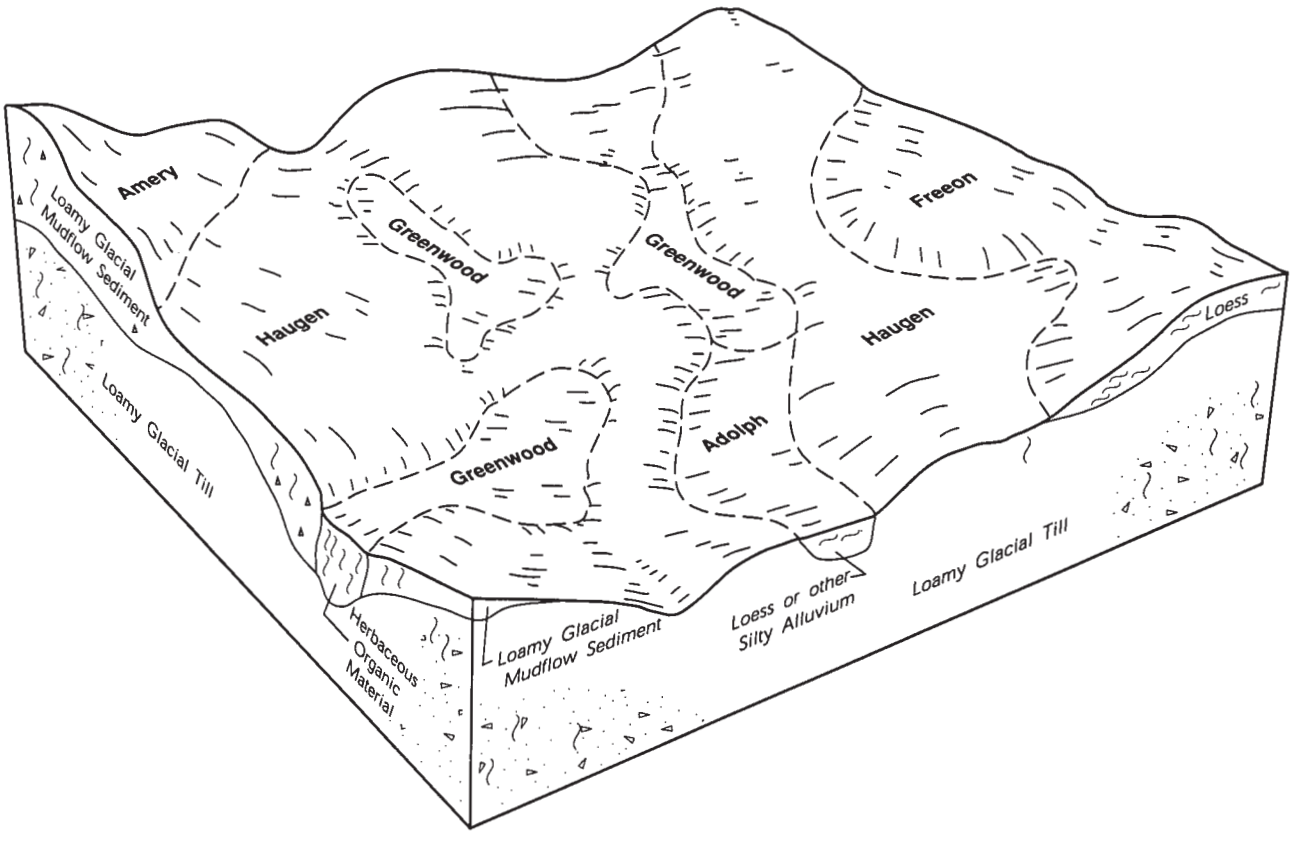

Figure 4.—Typical pattern of soils and parent material in the Haugen-Greenwood-Amery association.

erosion and soil blowing are hazards. Most areas have slopes that are too short or irregular for stripcropping or for contour farming. The Greenwood soils are generally unsuited to cultivated crops because of wetness, a lack of suitable drainage outlets, and the hazard of frost in late spring and early fall. The Haugen and Amery soils are suited to trees. The Greenwood soils are generally unsuited to trees because of extreme acidity and the wetness.

The less sloping areas of the Haugen soils are suited to dwellings without basements but are only moderately suited to dwellings with basements because of the wetness. The Haugen soils are poorly suited to septic tank absorption fields because of the wetness and the slow permeability in the substratum. The Greenwood soils are generally unsuitable for building sites and septic tank absorption fields because of the wetness. The Amery soils are poorly suited to septic tank absorption fields and dwellings because of the slope.

5. Freeon-Spencer-Magnor Association

Deep or very deep, nearly level to sloping, moderately well drained and somewhat poorly drained, silty soils on moraines

This association makes up about 18 percent of the county. It is about 41 percent Freeon and similar soils, 21 percent Spencer and similar soils, 9 percent Magnor and similar soils, and 29 percent soils of minor extent (fig. 5).

Freeon soils are gently sloping and sloping and are moderately well drained. They are deep or very deep to dense till. They are in plane or slightly convex areas and on side slopes and knolls on moraines. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next 12 inches is brown and dark yellowish brown, mottled silt loam. Below this is 20 inches of dark brown and brown, mottled sandy loam. The subsoil is dark reddish brown, mottled, friable sandy loam about 46 inches thick. The substratum to a depth of 99 inches or more is reddish brown, firm sandy loam.

Spencer soils are very deep, gently sloping and sloping, and moderately well drained. They are on side slopes and knolls on ground moraines. Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is brown and dark yellowish brown silt loam about 18 inches thick. The subsoil is about 18 inches thick. It is dark yellowish brown, mottled, friable silt loam in the upper part and dark brown, mottled, friable loam in the lower part. The substratum to a depth of 72 inches or more is reddish brown sandy loam.

Magnor soils are nearly level and gently sloping and are somewhat poorly drained. They are deep to dense till. They formed in loess or other silty deposits and in the underlying dense sandy loam or loam glacial till. They are in plane or slightly concave areas and in drainageways on moraines. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 2 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 14 inches thick. The subsoil is reddish brown, mottled, friable sandy loam about 26 inches thick. The substratum to a depth of 60 inches or more is reddish brown, firm sandy loam.

Of minor extent in this association are Amery, Anigon, Arland, Chetek, Fordum, Haugen, and Seelyeville soils. The well drained Amery soils are on ridgetops and side slopes. They formed in loamy glacial mudflow sediment and in the underlying sandy loam or loam glacial till. The well drained Anigon soils are in slightly convex areas and on side slopes. They formed in loess or silty alluvium and in loamy alluvium overlying sandy outwash. The well drained Arland soils are on ridgetops and side slopes. They formed in loamy glacial till or in loess and loamy glacial till underlain by sandstone or sandy residuum and sandstone. The somewhat excessively drained Chetek soils are in slightly convex areas and on side slopes. They formed in loamy alluvium and in the underlying sandy outwash. The poorly drained Fordum soils formed in silty and loamy alluvium underlain by sandy alluvium. They are on flood plains. The moderately well drained Haugen soils formed in loamy glacial mudflow sediment and in the underlying dense glacial till. They are on ridgetops and side slopes. The very poorly drained Seelyeville soils formed in herbaceous organic material. They are in depressions.

Most of the less sloping areas of this association are used as cropland or pasture. The less sloping areas of the major soils are suited to cultivated crops, but water erosion is a hazard in areas where the slope is more than 2 percent. The major soils are suited to trees.

The major soils are poorly suited or only moderately suited to dwellings and to septic tank absorption fields

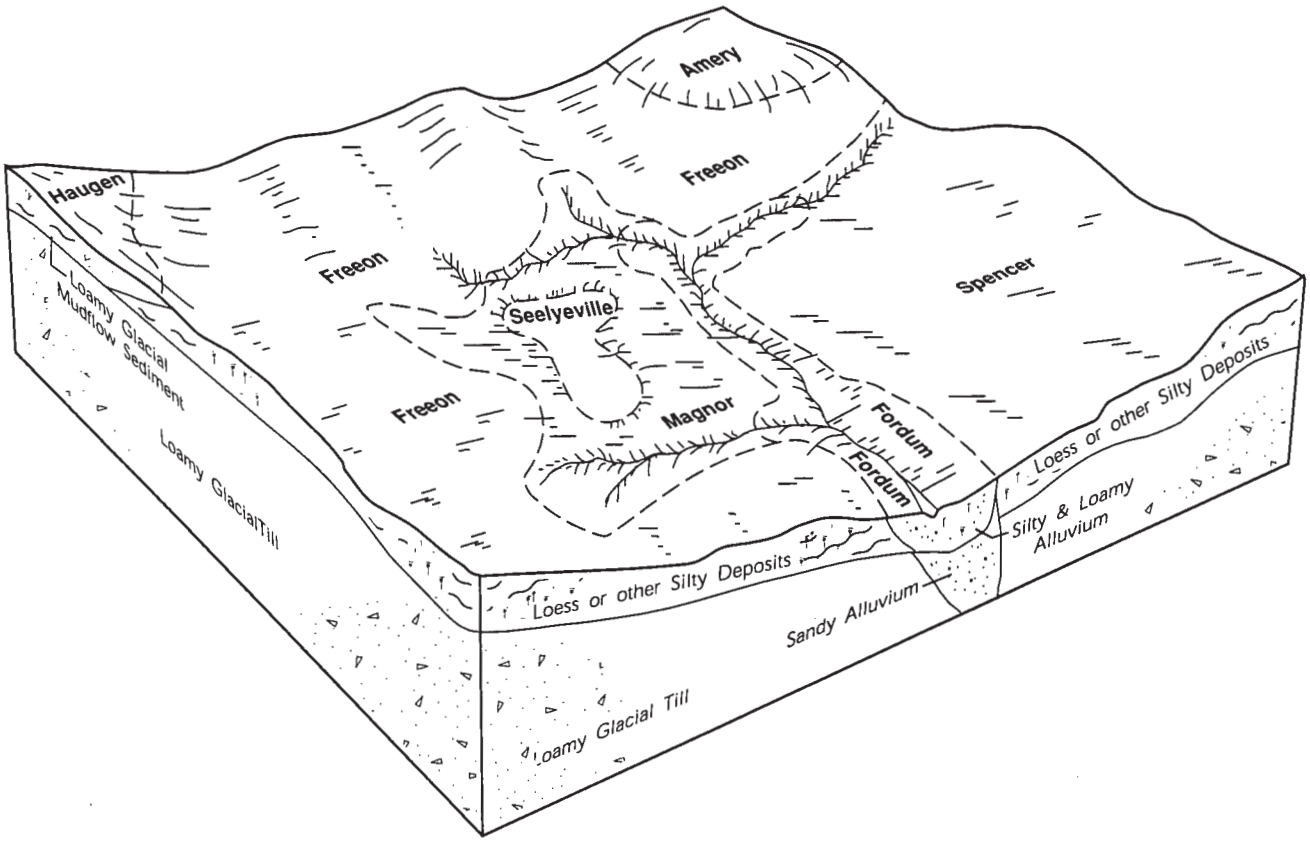

Figure 5.—Typical pattern of soils and parent material in the Freeon-Spencer-Magnor association.

because of wetness. Moderately slow or slow permeability in the lower part of the subsoil and very slow permeability in the substratum are additional limitations if the Freeon and Magnor soils are used as sites for septic tank absorption fields.

6. Freeon-Haugen-Magnor Association

Deep or very deep, nearly level to moderately steep, moderately well drained and somewhat poorly drained, loamy and silty soils on moraines

This association makes up about 11 percent of the county. It is about 53 percent Freeon and similar soils, 14 percent Haugen soils, 11 percent Magnor and similar soils, and 22 percent soils of minor extent.

Freeon soils are gently sloping and sloping and are moderately well drained. They are deep or very deep to dense till. They are in plane or slightly convex areas and on side slopes and knolls on moraines. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next 12 inches is brown and dark yellowish brown, mottled silt loam. Below this is 20 inches of dark brown and brown, mottled sandy loam. The subsoil is dark reddish brown, mottled, friable sandy loam about 46 inches thick. The substratum to a depth of 99 inches or more is reddish brown, firm sandy loam.

Haugen soils are gently sloping to moderately steep and are moderately well drained. They are deep or very deep to dense till. They are on ridgetops and side slopes on moraines. Typically, the surface layer is very dark brown sandy loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown, friable sandy loam about 19 inches thick. Below this is dark reddish brown and reddish brown, mottled, friable sandy loam about 26 inches thick. The lower part of the subsoil is about 30 inches thick. It is reddish brown, friable gravelly loamy sand in the upper part and dark reddish brown, firm sandy loam in the lower

part. The substratum to a depth of 88 inches or more is reddish brown, firm sandy loam.

Magnor soils are nearly level and gently sloping and are somewhat poorly drained. They are deep to dense till. They are in plane or slightly concave areas and in drainageways on moraines. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 2 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 14 inches thick. The subsoil is reddish brown, mottled, friable sandy loam about 26 inches thick. The substratum to a depth of 60 inches or more is reddish brown, firm sandy loam.

Of minor extent in this association are Amery, Anigon, Arland, Chetek, Santiago, and Seelyeville soils. The well drained Amery soils formed in loamy glacial mudflow sediment and in the underlying dense sandy loam glacial till. They are on ridgetops and side slopes. The well drained Anigon soils formed in loess or silty alluvium and in loamy alluvium underlain by sandy outwash. They are in slightly convex areas and on side slopes. The well drained Arland soils formed in loamy glacial till or in loess and loamy glacial till underlain by sandstone or sandy residuum and sandstone. They are on knolls, ridgetops, and side slopes. The somewhat excessively drained Chetek soils formed in loamy alluvium and in the underlying sandy outwash. They are in slightly convex areas and on side slopes. The well drained Santiago soils formed in loess or other silty deposits and in the underlying dense loamy glacial till. They are on side slopes and in slightly convex areas. The very poorly drained Seelyeville soils formed in herbaceous organic material. They are in depressions.

Most areas of the less sloping soils in this association are used as cropland or pasture. Some areas are wooded. The less sloping major soils are suited to cultivated crops, but water erosion is a hazard. Wetness is an additional limitation in areas of the Magnor soils, and soil blowing is an additional limitation in areas of the Haugen soils. The major soils are suited to trees.

The Freeon and Magnor soils are moderately suited or poorly suited to dwellings because of wetness. The less sloping areas of the Haugen soils are suited to dwellings without basements but are only moderately suited to dwellings with basements because of the wetness. The more sloping areas of the Haugen soils are only moderately suited to dwellings because of the slope. All of the major soils are poorly suited to septic tank absorption fields because of the wetness and because of moderately slow or slow permeability in the lower part of the subsoil and very slow permeability in the substratum.

7. Crystal Lake-Comstock-Barronett Association

Very deep, nearly level and gently sloping, moderately well drained to poorly drained, silty soils on glacial lake plains

This association makes up about 2 percent of the county. It is about 40 percent Crystal Lake soils, 15 percent Comstock soils, 9 percent Barronett soils, and 36 percent soils of minor extent.

Crystal Lake soils are nearly level and gently sloping and are moderately well drained. They are in plane or slightly convex areas on glacial lake plains. Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The next layer is dark brown and brown silt loam about 8 inches thick. The subsoil is dark brown, mottled, friable silt loam about 14 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown, mottled silt loam.

Comstock soils are nearly level and are somewhat poorly drained. They are in slightly concave areas and depressions on glacial lake plains. Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown, mottled silt loam about 3 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 14 inches thick. The subsoil is dark yellowish brown, mottled, friable silt loam about 14 inches thick. The substratum to a depth of 60 inches or more is yellowish brown, mottled silt loam.

Barronett soils are nearly level and are poorly drained. They are in plane or slightly concave areas on glacial lake plains. Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 5 inches thick. The subsoil is light brownish gray, mottled, friable silt loam about 23 inches thick. The substratum to a depth of 60 inches or more is light brownish gray, mottled silt loam.

Of minor extent in this association are Anigon, Chetek, Rosholt, and Seelyeville soils. The well drained Anigon soils formed in loess or silty alluvium and in loamy alluvium overlying sandy outwash. They are in slightly convex areas and on side slopes. The somewhat excessively drained Chetek and well drained Rosholt soils formed in loamy alluvium and in the underlying sandy outwash. They are in convex

areas and on side slopes. The very poorly drained Seelyeville soils formed in herbaceous organic material. They are in depressions.

Most areas of this association are used as cropland or pasture. The major soils are suited to cultivated crops, but water erosion is a hazard in the sloping areas. Wetness is a hazard in areas of the Comstock and Barronett soils. The major soils are suited to trees.

The major soils are poorly suited or only moderately suited to dwellings because of wetness and a moderate shrink-swell potential. The major soils are poorly suited or only moderately suited to septic tank absorption fields because of the wetness and moderately slow permeability in the substratum. The Barronett soils are subject to flooding and ponding.

8. Ribhill-Magnor-Freeon Association

Moderately deep to very deep, nearly level to very steep, well drained to somewhat poorly drained, silty soils on quartzite monadnocks and moraines

This association makes up about 2 percent of the county. It is about 59 percent Ribhill soils, 14 percent Magnor and similar soils, 9 percent Freeon and similar soils, and 18 percent soils of minor extent.

Ribhill soils are moderately deep, gently sloping to very steep, and well drained. They are on ridgetops and side slopes of quartzite monadnocks on moraines. Stones are on the surface in most areas. Typically, the surface layer is very dark brown cobbly silt loam about 3 inches thick. The subsurface layer is brown cobbly silt loam about 3 inches thick. The next layer is dark yellowish brown and yellowish brown very cobbly silt loam about 7 inches thick. The subsoil is about 25 inches thick. It is dark brown cobbly silt loam in the upper part and reddish brown and dark brown cobbly sandy loam and very cobbly sandy loam in the lower part. Fractured quartzite bedrock is at a depth of about 38 inches.

Magnor soils are nearly level and gently sloping and are somewhat poorly drained. They are deep to dense till. They are in plane or slightly concave areas and in drainageways on moraines. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 2 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 14 inches thick. The subsoil is reddish brown, mottled, friable sandy loam about 26 inches thick. The substratum to a depth of 60 inches or more is reddish brown, firm sandy loam.

Freeon soils are gently sloping and sloping and are moderately well drained. They are deep or very deep to dense till. They are in plane or slightly convex areas and on side slopes and knolls on moraines. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next 12 inches is brown and dark yellowish brown, mottled silt loam. Below this is 20 inches of dark brown and brown, mottled sandy loam. The subsoil is dark reddish brown, mottled, friable sandy loam about 46 inches thick. The substratum to a depth of 99 inches or more is reddish brown, firm sandy loam.

Of minor extent in this association are Capitola and Haugen soils and areas of Rubble land. The poorly drained Capitola soils formed in silty alluvium and in the underlying sandy loam glacial till. They are in drainageways and depressions. The moderately well drained Haugen soils formed in loamy glacial mudflow sediment and in the underlying dense loamy glacial till. They are on ridgetops and side slopes. Areas of Rubble land consist of several feet of angular quartzite cobbles and stones. They are on side slopes.

Most areas of this association are wooded. The Ribhill soils are generally unsuited to cropland or pasture because of the slope and the many cobbles and stones. Some areas of the Magnor and Freeon soils are used as cropland or pasture. The Magnor and Freeon soils are suited to cultivated crops, but water erosion is a hazard. Wetness is an additional limitation in areas of the Magnor soils. All of the major soils in this association are suited to trees.

The Ribhill soils are generally unsuited to dwellings and to septic tank absorption fields because of the depth to bedrock and the large stones. The Magnor soils are poorly suited to dwellings because of the wetness, and the Freeon soils are only moderately suited to dwellings. The Magnor and Freeon soils are poorly suited to septic tank absorption fields because of the wetness and because of restricted permeability in the lower part of the subsoil and in the substratum.

9. Cress-Mahtomedi-Seelyeville Association

Very deep, nearly level to steep, excessively drained, somewhat excessively drained, and very poorly drained soils on pitted outwash plains and end moraines

This association makes up about 1 percent of the county. It is about 42 percent Cress and similar soils, 25 percent Mahtomedi soils, 9 percent Seelyeville and similar soils, and 24 percent soils of minor extent.

Cress soils are sloping to steep and are somewhat excessively drained. They are on ridgetops and side slopes on pitted outwash plains and end moraines. Typically, the surface layer is very dark brown sandy

loam about 3 inches thick. The subsoil is about 33 inches thick. It is dark yellowish brown, friable sandy loam in the upper part; dark yellowish brown, very friable loamy sand in the next part; and dark brown, loose gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is reddish brown, stratified gravelly sand and sand. In some places the slope is less than 15 percent or more than 25 percent.

Mahtomedi soils are sloping to steep and are excessively drained. They are on ridgetops and side slopes on pitted outwash plains and end moraines. Typically, the surface layer is very dark grayish brown loamy sand about 4 inches thick. The subsoil is dark brown and reddish brown, very friable sand about 22 inches thick. The substratum to a depth of 60 inches or more is reddish brown, stratified gravelly sand and sand. In some places the slope is less than 15 percent or more than 25 percent.

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

Of minor extent in this association are Anigon, Crystal Lake, and Haugen soils. The well drained Anigon soils formed in loess or silty alluvium and in loamy alluvium underlain by sandy outwash. They are in slightly convex areas and on side slopes. The moderately well drained Crystal Lake soils formed in silty lacustrine deposits. They are in plane and slightly convex areas. The moderately well drained Haugen soils formed in loamy glacial mudflow sediment and in the underlying dense loamy glacial till. They are on side slopes.

Most areas of this association are wooded. The Cress and Mahtomedi soils are generally unsuited to cultivated crops and are poorly suited to pasture because of the hazards of erosion, droughtiness, and soil blowing. The Seelyeville soils are generally unsuited to cultivated crops because of wetness, a lack of suitable drainage outlets, and a hazard of frost in late spring and early fall. The Cress and Mahtomedi soils are suited to trees. The Seelyeville soils are poorly suited to trees because of the wetness.

The Cress and Mahtomedi soils are moderately suited or poorly suited to dwellings because of the slope. The effluent from septic tank absorption fields will drain satisfactorily in areas of the Cress and Mahtomedi soils, but the pollution of ground water is a concern because of the rapid or very rapid permeability in the substratum. The more sloping areas of these soils are poorly suited to septic tank absorption fields because of the slope. The Seelyeville soils are generally unsuited to dwellings and septic tank absorption fields because of the wetness.

10. Freeon-Magnor-Newood Association

Deep or very deep, nearly level to moderately steep, moderately well drained and somewhat poorly drained soils on moraines

This association makes up about 4 percent of the county. It is about 40 percent Freeon and similar soils, 29 percent Magnor and similar soils, 13 percent Newood soils, and 18 percent soils of minor extent.

Freeon soils are gently sloping and sloping and are moderately well drained. They are deep or very deep to dense till. They are in plane or slightly convex areas and on side slopes and knolls on moraines. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next 12 inches is brown and dark yellowish brown, mottled silt loam. Below this is 20 inches of dark brown and brown, mottled sandy loam. The subsoil is dark reddish brown, mottled, friable sandy loam about 46 inches thick. The substratum to a depth of 99 inches or more is reddish brown, firm sandy loam.

Magnor soils are nearly level and gently sloping and are somewhat poorly drained. They are deep to dense till. They are in plane or slightly concave areas and in drainageways on moraines. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 2 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 14 inches thick. The subsoil is reddish brown, mottled, friable sandy loam about 26 inches thick. The substratum to a depth of 60 inches or more is reddish brown, firm sandy loam.

Newood soils are gently sloping to moderately steep and are moderately well drained. They are deep or very deep to dense till. They are on ridgetops and side slopes on moraines. Typically, the surface layer is covered by 1 inch of black muck. The surface layer is dark grayish brown sandy loam about 2 inches thick. The upper part of the subsoil is dark brown, friable loamy sand and sandy loam about 18 inches thick. The lower part is brown, dark brown, and reddish brown, mottled, friable sandy loam about 24 inches thick. The substratum to a depth of 80 inches or more is yellowish red, firm sandy loam.

Of minor extent in this association are Anigon, Arland, Capitola, Newot, and Ribhill soils. The well

drained Anigon soils formed mostly in loess or silty alluvium and in loamy alluvium underlain by sandy outwash. They are in slightly convex areas and on side slopes. The well drained Arland soils formed in loamy glacial till or in loess and loamy glacial till underlain by sandstone or sandy residuum and sandstone. They are on ridgetops and side slopes. The poorly drained Capitola soils formed in silty alluvium and in the underlying loamy glacial till. They are in drainageways and depressions. The well drained Newot soils formed in loamy glacial till. They are on side slopes on moraines. The well drained Ribhill soils formed in loess and loamy glacial till overlying quartzite bedrock. They are on ridgetops and side slopes.

Most areas of this association are wooded. Some areas are used as cropland or pasture. All of the major soils are suited to cultivated crops, but water erosion is a hazard. Wetness is an additional limitation in areas of the Magnor soils, and soil blowing is an additional limitation in areas of the Newood soils. The major soils are suited to trees.

The Freeon and Magnor soils are moderately suited or poorly suited to dwellings because of wetness. The less sloping areas of the Newood soils are suited to dwellings without basements but are only moderately suited to dwellings with basements because of wetness. The more sloping areas of the Newood soils are only moderately suited to dwellings because of the slope. All of the major soils are poorly suited to septic tank absorption fields because of the wetness and because of moderately slow or slow permeability in the lower part of the subsoil and very slow permeability in the substratum.

11. Newood-Newot Association

Gently sloping to very steep, well drained and moderately well drained, loamy soils that are deep or very deep to dense till; on moraines

This association makes up about 1 percent of the county. It is about 57 percent Newood soils, 19 percent Newot soils, and 24 percent soils of minor extent.

Newood soils are gently sloping to moderately steep and are moderately well drained. They are on ridgetops and side slopes on moraines. Typically, the surface layer is covered by 1 inch of black muck. The surface layer is dark grayish brown sandy loam about 2 inches thick. The upper part of the subsoil is dark brown, friable loamy sand and sandy loam about 18 inches thick. The next part is brown, dark brown, and reddish brown, mottled, friable sandy loam about 19 inches thick. The lower part is yellowish red, mottled, friable loamy sand about 24 inches thick. The substratum to a depth of 80 inches or more is yellowish red, firm sandy loam.

Newot soils are moderately steep to very steep and are well drained. They are on ridgetops and side slopes on moraines. Typically, the surface layer is covered by 2 inches of black mucky peat. The surface layer is brown sandy loam about 2 inches thick The upper part of the subsoil is dark brown, friable sandy loam about 17 inches thick. The lower part of the subsoil is about 41 inches thick. It is dark reddish brown, friable sandy loam and reddish brown, very friable loamy sand. The substratum to a depth of 80 inches or more is dark reddish brown, firm, very compact sandy loam. In some areas the surface layer is fine sandy loam, loam, or silt loam.

Of minor extent in this association are Freeon, Chetek, and Rosholt soils. The moderately well drained Freeon soils formed in loess or other silty deposits and in the underlying dense loamy glacial till. They are in convex areas and on side slopes. The somewhat excessively drained Chetek and well drained Rosholt soils formed in loamy alluvium and in the underlying sandy outwash. They are in convex areas and on side slopes.

Most areas of this association are wooded. Some areas of the Newood soils and some of the less sloping areas of the Newot soils are used as cropland or pasture. The Newood soils and the less sloping areas of the Newot soils are suited to cultivated crops, but water erosion is a hazard in the sloping areas. Soil blowing is an additional hazard in areas of both soils. The major soils are suited to trees.

The less sloping areas of the Newood soils are suited to dwellings without basements, but they are only moderately suited to dwellings with basements because of wetness. The Newood soils are poorly suited to septic tank absorption fields because of the wetness and because of moderately slow or slow permeability in the lower part of the subsoil and very slow permeability in the substratum. The Newot soils are poorly suited to dwellings and to septic tank absorption fields because of the slope.

Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. 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 other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties 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, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit 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, 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, slope, stoniness, salinity, 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, Arland fine sandy loam, 6 to 12 percent slopes, eroded, is a phase of the Arland series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Cress-Mahtomedi complex, 15 to 25 percent slopes, is an example.

An *undifferentiated group* is made up of two or

more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Seelyeville and Cathro mucks, 0 to 1 percent slopes, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rubble land is an example.

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

Ad—Adolph silt loam, 0 to 2 percent slopes

This nearly level, very poorly drained soil is in depressions and drainageways on ground moraines. It is moderately deep or deep to dense till. It is subject to ponding. Individual areas are long and narrow or irregularly shaped and generally range from 10 to 40 acres in size.

Typically, the surface layer is black silt loam about 13 inches thick. The subsoil is about 23 inches thick. It is grayish brown, mottled, friable silt loam in the upper part and grayish brown, mottled, friable sandy loam in the lower part. The substratum to a depth of 60 inches or more is reddish brown, mottled, firm sandy loam. In some areas stones are on the surface.

Included with this soil in mapping are small areas of the somewhat poorly drained Magnor soils. These soils are in the slightly higher positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Adolph soil and very slow in the substratum. The available water capacity is moderate. The content of organic matter in the surface layer is high. The rooting depth of most plants is limited by a perched seasonal high water table, which is near or above the surface in undrained areas.

Most areas are used as unimproved pasture or as woodland. Undrained areas generally are not suited to cultivated crops because of the wetness and the frost hazard. Drained areas are suited to corn and small grain and to grasses and legumes for hay and pasture. The number of frost-free days per growing season is limited. Planting early maturing crop varieties or growing corn for silage helps to overcome the frost hazard.

This soil is poorly suited to pasture unless it is drained. Establishing or maintaining improved pasture is difficult because of the wetness. Grazing is limited to short periods when the soil is dry. The native vegetation generally is of poor quality for forage.

This soil is suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Because of the wetness, planting on prepared ridges generally is needed if natural regeneration is unreliable. Selecting vigorous nursery stock for planting reduces the seedling mortality rate. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the ponding. Overcoming this hazard is difficult. A better suited site should be considered.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 2W (black ash). A forest habitat type has not been assigned.

AfA—Aftad fine sandy loam, 0 to 3 percent slopes

This very deep, nearly level and gently sloping, moderately well drained soil is in plane areas on glacial lake plains. Individual areas are irregularly shaped and generally range from 20 to 100 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsurface layer is brown fine sandy loam about 2 inches thick. The next layer is brown, dark yellowish brown, and dark brown fine sandy loam and loam about 11 inches thick. The subsoil is about 22 inches thick. It is mottled. The upper part is dark brown, friable loam, and the lower part is dark brown, friable silt loam. The substratum to a depth of 60 inches or more is dark brown, mottled silt loam. In some places the surface layer is loamy fine sand. In other places a few cobbles are on the surface.

Included with this soil in mapping are small areas of the somewhat poorly drained Comstock soils. These soils are in the lower positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Aftad soil. The available water capacity is high. The content of organic matter is moderately low in the surface layer. The depth to a perched seasonal high water table ranges from 2.5 to 3.5 feet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Applying a system of conservation tillage, returning crop residue to the soil, and adding other organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

This soil is suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness, this soil is poorly suited to septic tank absorption fields. Mounding the site with suitable filtering material helps to overcome this limitation. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

This soil is suited to dwellings without basements. The wetness is a limitation on sites for dwellings with basements. It can be overcome by constructing foundations on coarse textured fill material, such as sand or gravel, above the level of wetness and by installing tile drains around the foundations and providing gravity outlets or other dependable outlets.

Because of the potential for frost action, this soil is only moderately suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is I. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt or AVDe.

AhA—Almena silt loam, 0 to 3 percent slopes

This very deep, nearly level and gently sloping, somewhat poorly drained soil is on footslopes and in slightly concave areas on ground moraines. Individual areas are irregularly shaped and generally range from 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The subsurface layer is brown, mottled silt loam about 2 inches thick. The next layer is brown, dark yellowish brown, and dark brown, mottled silt loam about 11 inches thick. The subsoil is about 28 inches thick. It is dark brown, mottled, friable silt loam in the upper part and dark brown, mottled, friable sandy loam in the lower part. The substratum to a depth of 60 inches or more is yellowish red sandy loam. In some areas the slope is more than 3 percent.

Included with this soil in mapping are small areas of the poorly drained Auburndale and moderately well drained Spencer soils. Auburndale soils are in depressions and drainageways in the lower positions on the landscape. Spencer soils are in the slightly higher positions on the landscape. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Almena soil and moderate or moderately slow in the till. The available water capacity is very high. The content of organic matter is moderate or high in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by a perched seasonal high water table, which is at a depth of 1.0 to 2.5 feet in undrained areas.

Most areas are used as cropland. If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight hazard. Applying a system of conservation tillage and returning crop residue to the soil or adding other organic material can help to maintain fertility and good tilth and increase the rate of water infiltration. Land smoothing, a surface drainage system, diversions, and grassed waterways help to remove excess water.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Alfalfa is generally short lived because of the seasonal high

water table and the winterkill caused by frost heave. Red clover is generally grown. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. On some sites, mounding with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

Because of the wetness, this soil is poorly suited to dwellings. This limitation can be overcome by constructing foundations on coarse textured fill material, such as sand or gravel, above the level of wetness and by installing tile drains around the foundations and providing gravity outlets or other dependable outlets.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement or the base material. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIw. The woodland ordination symbol is 3W (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

AID—Amery sandy loam, 12 to 25 percent slopes

This moderately steep and steep, well drained soil is on ridgetops, side slopes, and knolls on moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 10 to 150 acres in size.

Typically, the surface layer is black sandy loam about 3 inches thick. The upper part of the subsoil is yellowish brown, friable sandy loam about 19 inches thick. The next part is brown, dark brown, and reddish brown, friable sandy loam about 19 inches thick. The lower part of the subsoil is reddish brown, friable gravelly sandy loam and sandy loam about 30 inches thick. The substratum to a depth of 80 inches or more is dark reddish brown, firm sandy loam. In some places the substratum is loamy sand. In a few areas the slope is less than 12 percent.

Included with this soil in mapping are small areas of the very poorly drained Adolph, somewhat excessively drained Cress, and moderately well drained Haugen soils. Adolph soils are in depressions and drainageways. Cress soils formed in loamy alluvium underlain by stratified sandy outwash. They are in positions on the landscape similar to those of the Amery soil. Haugen soils are in the slightly lower positions on the landscape. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the subsoil in the Amery soil. It is moderately slow in the lower part of the subsoil and slow or very slow in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. Also, the soil is subject to soil blowing. Most areas have slopes that are too short or irregular for stripcropping or contour farming. Using a system of conservation tillage and planting winter cover crops help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause

surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, seedling mortality, the equipment limitation, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the slope and the very slow permeability in the substratum, this soil is poorly suited to septic tank absorption fields. The slope can be overcome by cutting and filling or by installing a trench absorption system on the contour. Also, the absorption field can be installed in areas of included soils where the slope is less than 12 percent.

Because of the slope, this soil is poorly suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 12 percent.

Because of the slope, this soil is poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is IVe. The woodland ordination symbol is 4R (northern red oak). The primary forest habitat type is AAt, and the secondary type is AVDe.

AmD—Amery-Greenwood complex, 0 to 35 percent slopes

These soils are on moraines. The well drained, moderately steep to very steep Amery soil is deep or very deep to dense till. It is on ridgetops, side slopes, and knolls. It has slopes of 15 to 35 percent. In most areas, stones are on the surface. The nearly level, very deep, very poorly drained Greenwood soil is in depressions. It has slopes of 0 to 1 percent. It is subject to ponding. Individual areas of this unit are irregularly shaped and generally range from 100 to 300 acres in size. They are 60 to 70 percent Amery soil and 20 to 30 percent Greenwood soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Amery soil is black sandy loam about 3 inches thick. The upper part of the subsoil is yellowish brown, friable sandy loam about 19 inches thick. The next part is brown, dark brown, and reddish brown, friable sandy loam about 19 inches thick. The lower part of the subsoil is reddish brown, friable sandy loam about 30 inches thick. The substratum to a depth of 80 inches or more is dark reddish brown, dense sandy loam. In some places the substratum is loamy sand. In a few areas the slope is less than 15 percent.

Typically, the organic material in the Greenwood soil is at least 60 inches thick. The upper part is yellowish brown peat, and the lower part is dark yellowish brown, dark brown, and dark reddish brown mucky peat.

Included with these soils in mapping are small areas of the very poorly drained Adolph and moderately well drained Haugen soils. Adolph soils formed in silty alluvium and in the underlying dense sandy loam glacial till. They are in positions on the landscape similar to those of the Greenwood soil. Haugen soils are in positions on the landscape slightly lower than those of the Amery soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the subsoil in the Amery soil. It is moderately slow in the lower part of the subsoil and slow or very slow in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer.

Permeability is moderate or moderately rapid in the Greenwood soil. The available water capacity is very high. The content of organic matter also is very high. The rooting depth of most plants is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas of this unit are wooded. The Amery soil is generally not suited to corn and small grain or to grasses and legumes for hay and pasture because of the stones on the surface. Removing these stones is difficult and costly. Because of the wetness, a scarcity of suitable drainage outlets, a hazard of frost in late spring or early fall, and an extremely acid reaction, the

Greenwood soil is generally not suited to cultivated crops or pasture.

The Amery soil is suited to trees. The hazard of water erosion, seedling mortality, the equipment limitation, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the extremely acid condition and the high water table, the Greenwood soil is generally unsuited to trees. The trees grow so poorly and are so poorly shaped that they are barely merchantable at best.

Because of the slope and the slow or very slow permeability in the substratum, the Amery soil is poorly suited to septic tank absorption fields. The slope can be overcome by cutting and filling or by installing a trench absorption system on the contour. Also, the absorption field can be installed in areas of included soils where the slope is less than 15 percent.

Because of the slope, the Amery soil is poorly suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 15 percent.

Because of the slope, the Amery soil is poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The Greenwood soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the ponding and low strength. Overcoming these limitations is difficult. A better suited site should be considered.

The land capability classification is VIIe. The woodland ordination symbol is 4R (northern red oak) for the Amery soil and 2W (black spruce) for the Greenwood soil. The primary forest habitat type for the Amery soil is AAt, and the secondary type is AVDe. A forest habitat type has not been assigned for the Greenwood soil.

AnA—Anigon silt loam, 0 to 2 percent slopes

This very deep, nearly level, well drained soil is in plane areas on outwash plains. Individual areas are irregularly shaped and generally range from 10 to 100 acres in size.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsurface layer is pale brown silt loam about 2 inches thick. The next layer is pale brown, brown, and dark brown silt loam about 11 inches thick. The subsoil is about 19 inches thick. It is dark brown, friable silt loam in the upper part and dark brown, friable loam in the lower part. The substratum to a depth of 60 inches or more is strong brown, stratified very gravelly sand and sand. In places the substratum has little or no gravel. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the moderately well drained Brill soils. These soils are in the slightly lower positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Anigon soil, moderate or moderately rapid in the loamy lower part of the subsoil, and rapid or very rapid in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by droughtiness in the substratum.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Applying a system of conservation tillage and returning crop residue to the soil or adding other organic material can help to maintain fertility and good tilth and increase the rate of water infiltration.

This soil is suited to pasture. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns.

Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is suited to dwellings. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity.

Because of the potential for frost action, this soil is poorly suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIs in nonirrigated areas and I in irrigated areas. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

AnB—Anigon silt loam, 2 to 6 percent slopes

This very deep, gently sloping, well drained soil is in plane or slightly convex areas on outwash plains. Individual areas are irregularly shaped and generally range from 10 to 100 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsurface layer is pale brown silt loam about 3 inches thick. The next layer is light brownish gray and dark yellowish brown silt loam about 5 inches thick. The subsoil is about 20 inches thick. It is dark brown, friable silt loam in the upper part and dark brown, friable loam in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, stratified gravelly sand and sand. In places the substratum has little or no gravel. In some areas the slope is less than 2 percent or more than 6 percent.

Included with this soil in mapping are small areas of the moderately well drained Brill soils. These soils are in the slightly lower positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Anigon soil, moderate or moderately rapid in the loamy lower part of the subsoil, and rapid or very rapid in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by droughtiness in the substratum.

Most areas are used as cropland. A few areas are used as pasture or woodland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is suited to dwellings. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity.

Because of the potential for frost action, this soil is poorly suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

AnC2—Anigon silt loam, 6 to 12 percent slopes, eroded

This very deep, sloping, well drained soil is on convex side slopes on outwash plains. Individual areas are irregularly shaped and generally range from 5 to 15 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 5 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 10 inches thick. The subsoil is about 16 inches thick. It is dark brown, friable silt loam in the upper part; strong brown, friable loam in the next part; and yellowish brown, very friable sandy loam in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, stratified gravelly sand and sand. In places the substratum has little or no gravel. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek soils. These soils have a loamy mantle. They are in the slightly higher positions on the landscape. They make up 10 to 15 percent of the unit.

Permeability is moderate in the silty mantle of the Anigon soil, moderate or moderately rapid in the loamy lower part of the subsoil, and rapid or very rapid in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by droughtiness in the substratum.

Most areas are used as cropland. A few areas are used as pasture or woodland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the potential for frost action, this soil is poorly suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

ApB—Arland fine sandy loam, 2 to 6 percent slopes

This moderately deep, gently sloping, well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregularly shaped and generally range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsurface layer is dark brown fine sandy loam about 2 inches thick. The next layer is dark brown and dark yellowish brown loam about 9 inches thick. The subsoil is dark brown, friable sandy loam about 7 inches thick. The substratum is yellowish brown sand about 10 inches thick. Below this to a depth of 60 inches or more is sandstone. In places the surface layer is sandy loam, loam, or silt loam. In some areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of the well drained Amery soils. These soils are underlain by sandy loam till. They are in positions on the landscape similar to those of the Arland soil. They make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Arland soil and moderately slow or moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by the underlying sandstone.

Most areas are used as cropland. A few areas are used as pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, water erosion is a slight or moderate hazard. Also, the soil is subject to soil blowing. Conservation tillage and field windbreaks help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

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

Because of the thin layer of soil over sandstone, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity.

This soil is suited to dwellings and local roads and streets.

The land capability classification is IIe. The woodland ordination symbol is 4A (northern red oak). The primary forest habitat type is AAt, and the secondary type is ACaCi or AVDe.

ApC2—Arland fine sandy loam, 6 to 12 percent slopes, eroded

This moderately deep, sloping, well drained soil is on knolls and ridges in the uplands. Individual areas are irregularly shaped and generally range from 5 to 40 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The next layer is dark brown and reddish brown sandy loam about 13 inches thick. The subsoil is reddish brown, friable sandy loam about 13 inches thick. Below this to a depth of 60 inches or more is sandstone. In places the surface layer is sandy loam, loam, or silt loam. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the well drained Amery soils. These soils are underlain by sandy loam till. They are in positions on the landscape similar to those of the Arland soil. They make up 10 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Arland soil and moderately slow or moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by the underlying sandstone.

Most areas are used as cropland. A few areas are used as pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, water erosion is a moderate hazard. Also, the soil is subject to soil blowing. Conservation tillage, field windbreaks, contour farming, and contour stripcropping help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that

improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the thin layer of soil over sandstone, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope, this soil is only moderately suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is IIIe. The woodland ordination symbol is 4A (northern red oak). The primary forest habitat type is AAt, and the secondary type is ACaCi or AVDe.

ApD—Arland fine sandy loam, 12 to 25 percent slopes

This moderately deep, moderately steep and steep, well drained soil is on knolls and ridges in the uplands. Individual areas are irregularly shaped and generally range from 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is brown sandy loam about 4 inches thick. The next layer is brown and dark yellowish brown loam about 4 inches thick. The subsoil is about 19 inches thick. It is friable. It is dark brown loam in the upper part and strong brown sandy loam in the lower part. Sandstone is at a depth of about 34 inches. In places the surface layer is sandy loam, loam, or silt loam. In some areas the slope is less than 12 percent.

Included with this soil in mapping are small areas of the well drained Amery soils. These soils are underlain by sandy loam till. They are in positions on the landscape similar to those of the Arland soil. They make up 10 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Arland soil and moderately slow or moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by the underlying sandstone.

Most areas are used as pasture or are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, water erosion is a severe hazard. Also, the soil is subject to soil blowing. Contour farming, contour stripcropping, crop rotations that include grasses and legumes, and conservation tillage help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, seedling mortality, the equipment limitation, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. Seedling mortality on the steeper south- or west-facing slopes can be minimized by using harvest methods that leave some mature trees to provide shade and protection and by planting vigorous nursery stock in the early spring, when the soil is moist. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the slope and the thin layer of soil over sandstone, this unit is generally unsuited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity

can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water.

Because of the slope, this soil is poorly suited to dwellings. This limitation can be overcome by cutting and filling or by installing retaining walls. Also, the dwellings can be designed so that one side of the basement fronts on the lower part of the slope.

Because of the slope, this soil is poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is IVe. The woodland ordination symbol is 4R (northern red oak). The primary forest habitat type is AAt, and the secondary type is ACaCi or AVDe.

AsB—Arland silt loam, 2 to 6 percent slopes

This moderately deep, gently sloping, well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregularly shaped and generally range from 5 to 20 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsurface layer also is dark brown silt loam. It is about 3 inches thick. The next layer is dark yellowish brown and dark brown silt loam about 4 inches thick. The subsoil is about 15 inches thick. It is friable. It is dark yellowish brown silt loam in the upper part, reddish brown loam in the next part, and yellowish red sandy loam in the lower part. The substratum is brownish yellow sand about 6 inches thick. Below this to a depth of 60 inches or more is sandstone. In places the subsoil is sandy clay loam. In some areas the surface layer is loam. In other areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of the well drained Santiago soils. These soils are underlain by sandy loam till. They are in positions on the landscape similar to those of the Arland soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Arland soil, moderate or moderately rapid in the loamy lower part of the subsoil, and moderately slow or moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by the underlying sandstone.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

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

Because of the thin layer of soil over sandstone, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity.

This soil is suited to dwellings and local roads and streets.

The land capability classification is IIe. The woodland ordination symbol is 4A (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

AsC2—Arland silt loam, 6 to 12 percent slopes, eroded

This moderately deep, sloping, well drained soil is on knolls and ridges in the uplands. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 9 inches thick. The next layer is dark yellowish brown and dark brown silt loam about 4 inches thick. The subsoil is about 20 inches thick. It is dark brown, friable silt loam in the upper part and reddish brown and yellowish red, friable sandy loam in the lower part. The substratum is brownish yellow sand about 5 inches thick. Below this

to a depth of 60 inches or more is sandstone. In places the subsoil is sandy clay loam. In some areas the surface layer is loam. In other areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the well drained Santiago soils. These soils are underlain by sandy loam till. They are in the slightly higher positions on the landscape. They make up 5 to 15 percent of the unit.

Permeability is moderate in the silty mantle of the Arland soil, moderate or moderately rapid in the loamy lower part of the subsoil, and moderately slow or moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by the underlying sandstone.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the thin layer of soil over sandstone, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope, this soil is only moderately suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required. Also, the road can be built in the less sloping included areas.

The land capability classification is IIIe. The woodland ordination symbol is 4A (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

Au—Auburndale silt loam, 0 to 2 percent slopes

This very deep, nearly level, poorly drained soil is on plane and concave slopes in depressions and drainageways on ground moraines. It is subject to ponding. Individual areas are elongated or irregularly shaped and generally range from 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is grayish brown, mottled silt loam about 7 inches thick. The subsoil is grayish brown, mottled, friable silt loam about 34 inches thick. The substratum to a depth of 60 inches or more is dark brown, mottled sandy loam. In places stones are on the surface.

Included with this soil in mapping are small areas of the somewhat poorly drained Almena soils. These soils are in the slightly higher positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Auburndale soil and moderately slow or moderate in the till. The available water capacity is high. The content of organic matter is high or very high in the surface layer. The rooting depth of most plants is limited by a perched seasonal high water table, which is near or above the surface in undrained areas.

Most areas are used as unimproved pasture or as woodland. Undrained areas generally are not suited to cultivated crops because of the wetness and the frost hazard. Drained areas are suited to corn and small grain and to grasses and legumes for hay and pasture. The number of frost-free days per growing season is limited. Planting early maturing crop varieties or growing corn for silage helps to overcome the frost hazard.

This soil is poorly suited to pasture unless it is drained. Establishing or maintaining improved pasture

is difficult because of the wetness. Grazing is limited to the short periods when the soil is dry. The native vegetation generally is of poor quality for forage.

This soil is suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Because of the wetness, planting on prepared ridges generally is needed if natural regeneration is unreliable. Selecting vigorous nursery stock for planting reduces the seedling mortality rate. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the ponding. Overcoming this hazard is difficult. A better suited site should be considered.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 2W (red maple). A forest habitat type has not been assigned.

Ba—Barronett silt loam, 0 to 2 percent slopes

This very deep, nearly level, poorly drained soil is in plane or slightly concave areas on glacial lake plains. It is subject to ponding and rare flooding. Individual areas are irregularly shaped and generally range from 20 to 100 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 5 inches thick. The subsoil is light brownish gray, mottled, friable silt loam about 23 inches thick. The substratum to a depth of 60 inches or more is light brownish gray, mottled silt loam. In places the surface layer is loam or muck.

Included with this soil in mapping are small areas of the somewhat poorly drained Comstock soils. These soils are in the slightly higher positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Barronett soil and moderately slow in the substratum. The available water capacity is very high. The content of organic matter is moderate or high in the surface layer. The surface layer is friable but tends to crust or puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas are used as cropland. Some areas are used as wetland wildlife habitat. A few areas are used as pasture or woodland. If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Dikes and diversions help to prevent flooding and ponding. Land smoothing, diversions, and interceptor subsurface drains help to remove excess water. Restrictive soil layers may hinder the movement of water to tile drains. If drainage tile is installed, silt enters the tile lines unless a suitable filter is used to cover the tile. Applying a system of conservation tillage and returning crop residue to the soil or adding other organic material can help to maintain fertility and tilth and increase the rate of water infiltration. The number of frost-free days per growing season is limited. Planting early maturing crop varieties or growing corn for silage helps to overcome the frost hazard.

This soil is suited to pasture. The surface layer is subject to crusting, which restricts the emergence of the plants. Alfalfa is generally short lived because of the seasonal high water table, the flooding, and the winterkill caused by frost heave. Red clover is generally grown. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Because of the wetness, planting on prepared ridges generally is needed if natural regeneration is unreliable. Selecting vigorous nursery stock for planting reduces the seedling mortality rate. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the flooding and the ponding. Overcoming these limitations is difficult. A better suited site should be considered.

The land capability classification is IIIw in drained areas and VIw in undrained areas. The woodland ordination symbol is 2W (tamarack). A forest habitat type has not been assigned.

Be—Beseman peat, 0 to 1 percent slopes

This very deep, nearly level, very poorly drained soil is in depressions on ground moraines and in lacustrine basins. It is subject to ponding. Individual areas are oblong and generally range from 10 to 60 acres in size.

Typically, the upper layer is dark brown peat about 3 inches thick. The lower layers are black and dark reddish brown muck about 28 inches thick. The substratum to a depth of 60 inches or more is very dark grayish brown and grayish brown silt loam. In some areas the surface layer is mucky peat or muck.

Included with this soil in mapping are small areas of the poorly drained and very poorly drained Barronett and very poorly drained Seelyeville soils. Barronett soils formed in silty lacustrine deposits. They are in the slightly higher positions on the landscape. Seelyeville soils formed in herbaceous organic material more than 51 inches thick. They are in positions on the landscape similar to those of the Beseman soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the organic part of the Beseman soil and moderately slow in the substratum. The available water capacity is very high. The content of organic matter also is very high. The rooting depth of most plants is limited by an apparent seasonal high water table, which is at or above the surface in undrained areas.

Most areas support wetland vegetation. Because of the wetness, a scarcity of suitable drainage outlets, and the hazard of frost in late spring or early fall, this soil is generally not suited to cultivated crops or pasture. If drained and cultivated, it is subject to burning and subsidence. Also, it is subject to soil blowing.

Because of the extremely acid condition and the high water table, this soil is generally unsuited to trees. The trees grow so poorly and are so poorly shaped that they are barely merchantable at best.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the ponding. Overcoming this hazard is difficult. A better suited site should be considered.

The land capability classification is VIIw in undrained areas. The woodland ordination symbol is 3W (black spruce). A forest habitat type has not been assigned.

BpA—Brill silt loam, 0 to 3 percent slopes

This very deep, nearly level and gently sloping, moderately well drained soil is in plane or slightly concave areas on outwash plains and stream terraces. Individual areas are irregularly shaped and generally range from 5 to 50 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The next layer is brown and dark yellowish brown silt loam about 8 inches thick. The subsoil is about 19 inches thick. It is mottled and friable. The upper part is dark brown silt loam, and the lower part is dark brown loam. The substratum to a depth of 60 inches or more is yellowish red, stratified gravelly sand and sand. In some areas the slope is more than 3 percent.

Included with this soil in mapping are small areas of the well drained Anigon and somewhat poorly drained Poskin soils. Anigon soils are in the slightly higher positions on the landscape. Poskin soils are in the slightly lower positions. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the silty mantle of the Brill soil, moderate or moderately rapid in the loamy lower part of the subsoil, and rapid or very rapid in the substratum. The available water capacity is moderate. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by droughtiness in the substratum. There is no seasonal high water table within a depth of 6 feet, but there is a seasonal zone of near saturation at a depth ranging from 1.5 to 3.5 feet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Applying a system of conservation tillage and returning crop residue to the soil or adding other organic material can help to maintain fertility and good tilth and increase the rate of water infiltration.

This soil is suited to pasture. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet

periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is suited to dwellings. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity. Also, the effluent can be pumped to an absorption field on a better suited soil in some nearby areas.

Because of the potential for frost action, this soil is poorly suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIs in nonirrigated areas and I in irrigated areas. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

CaC2—Campia silt loam, 6 to 12 percent slopes, eroded

This very deep, sloping, well drained soil is on side slopes and in convex areas on glacial lake plains. Individual areas are irregularly shaped and generally range from 5 to 50 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 9 inches thick. The next layer is brown and dark brown silt loam about 10 inches thick. The subsoil is reddish brown, friable silt loam about 15 inches thick. The substratum to a depth of 60 inches or more is reddish brown silt loam. In places the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the moderately well drained Crystal Lake soils. These soils are in positions on the landscape similar to those of the Campia soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the subsoil of the Campia soil and moderately slow in the substratum. The available water capacity is high. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the moderate permeability and the slope, this soil is only moderately suited to septic tank absorption fields. Increasing the size of the absorption field may overcome the restricted permeability in some areas. The slope can be overcome by cutting and filling or by installing a trench absorption system on the contour. Also, in some places the absorption field can be installed in areas of included soils where the slope is less than 6 percent.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. These limitations can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. Low strength also can be overcome by increasing the thickness of pavement or base material.

The land capability classification is IIIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

Cb—Capitola muck, 0 to 2 percent slopes

This very deep, nearly level, poorly drained soil is in depressions and drainageways on ground moraines. It is subject to ponding. Individual areas are long and narrow or irregularly shaped and generally range from 5 to 30 acres in size.

Typically, the surface layer is black muck about 3 inches thick. It is underlain by about 4 inches of black silt loam. The subsoil is about 29 inches thick. It is dark grayish brown and light brownish gray, mottled, friable silt loam in the upper part and dark brown, mottled, friable sandy loam in the lower part. The substratum to a depth of 60 inches or more is dark brown, mottled sandy loam. In some areas stones are on the surface.

Included with this soil in mapping are small areas of the somewhat poorly drained Magnor soils. These soils are in the slightly higher positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Capitola soil and moderately slow in the substratum. The available water capacity is moderate. The content of organic matter is very high in the surface layer. The rooting depth of most plants is limited by a perched seasonal high water table, which is near or above the surface in undrained areas.

Most areas are used as unimproved pasture or as woodland. Undrained areas generally are not suited to cultivated crops because of the wetness and the frost hazard. Drained areas are suited to corn and small grain and to grasses and legumes for hay and pasture. The number of frost-free days per growing season is limited. Planting early maturing crop varieties or growing corn for silage helps to overcome the frost hazard.

This soil is poorly suited to pasture unless it is drained. Establishing or maintaining improved pasture is difficult because of the wetness. Grazing is limited to short periods when the soil is dry. The native vegetation generally is of poor quality for forage.

This soil is suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Because of the wetness, hand planting or machine planting on prepared ridges generally is needed if natural regeneration is unreliable. Selecting vigorous nursery stock for planting reduces the seedling mortality rate. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the ponding. Overcoming this hazard is difficult. A better suited site should be considered.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 7W (balsam fir). A forest habitat type has not been assigned.

CkA—Chetek sandy loam, 0 to 2 percent slopes

This very deep, nearly level, somewhat excessively drained soil is in plane areas on outwash plains and stream terraces. Individual areas are irregularly shaped and generally range from 5 to 40 acres in size.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 10 inches thick. It is dark brown, friable sandy loam in the upper part and reddish brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is dark yellowish brown, stratified gravelly sand and sand. In places the depth to sand and gravel is more than 24 inches. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the excessively drained Menahga soils. These soils are sandy throughout. They are in positions on the landscape similar to those of the Chetek soil. They make up 2 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Chetek soil and rapid or very rapid in the sandy outwash. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the substratum.

Most areas are used as cropland. Some areas are used as pasture or woodland. Some areas have been planted to pine trees. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If irrigated, it is suited to vegetables, such as snap beans, potatoes, sweet corn, and peas (fig. 6). In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, soil blowing is a hazard. It can be controlled by conservation tillage, field windbreaks, and winter cover crops. Returning crop residue to the soil or adding other organic material minimizes the amount of water

Figure 6.—Irrigated snap beans in an area of Chetek sandy loam, 0 to 2 percent slopes. Irrigation is important in areas of this soil that are used for specialty crops.

lost through evaporation, helps to maintain fertility, increases the rate of water infiltration, and reduces the susceptibility to soil blowing.

A cover of pasture plants is effective in controlling soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

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

This soil is suited to dwellings and to local roads and streets. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IIIs in nonirrigated areas and IIs in irrigated areas. The woodland ordination symbol is 6A (jack pine). The primary forest habitat type is AVDe, and the secondary type is AAt or PAm.

CkB—Chetek sandy loam, 2 to 6 percent slopes

This very deep, gently sloping, somewhat excessively drained soil is in plane or slightly convex areas on outwash plains and stream terraces. Individual areas are irregularly shaped and generally range from 10 to 80 acres in size.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is about 10 inches thick. It is dark brown, friable sandy loam in the upper part and reddish brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, stratified gravelly sand and sand. In places the lower part of the subsoil is sandy loam. In some areas the

depth to sand and gravel is more than 24 inches. In a few areas the slope is less than 2 percent or more than 6 percent.

Included with this soil in mapping are small areas of the excessively drained Menahga soils. These soils are sandy throughout. They are in positions on the landscape similar to those of the Chetek soil. They make up 2 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Chetek soil and rapid or very rapid in the sandy outwash. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the sandy part of the subsoil and in the substratum.

Most areas are used as cropland. Some areas are used as pasture or woodland. Some areas have been planted to pine trees. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If irrigated, it is suited to vegetables, such as snap beans, potatoes, sweet corn, and peas. In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, water erosion is a slight or moderate hazard. Also, the soil is subject to soil blowing. Most areas have slopes that are too short and too irregular for stripcropping or contour farming. Conservation tillage, field windbreaks, and winter cover crops help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

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

This soil is suited to dwellings and to local roads and streets. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IIIe in nonirrigated areas and IIe in irrigated areas. The woodland ordination symbol is 6A (jack pine). The primary forest habitat type is AVDe, and the secondary type is AAt or PAm.

CkC2—Chetek sandy loam, 6 to 12 percent slopes, eroded

This very deep, sloping, somewhat excessively drained soil is on side slopes and in convex areas on outwash plains and stream terraces. Individual areas are irregularly shaped and generally range from 5 to 25 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown sandy loam about 4 inches thick. The subsoil is about 14 inches thick. It is brown and dark brown, friable sandy loam in the upper part and reddish brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is strong brown, stratified gravelly sand and sand. In places the surface layer has a few cobbles. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the excessively drained Menahga soils. These soils are sandy throughout. They are in positions on the landscape similar to those of the Chetek soil. Also included, on knolls and sharp slope breaks, are a few areas of soils that have a surface layer of gravelly loamy sand. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Chetek soil and rapid or very rapid in the sandy outwash. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the substratum.

Most areas are used as cropland or pasture. A few areas are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, water erosion is a moderate hazard. Also, the soil is subject to soil blowing. Most areas have slopes that are too short and too irregular for stripcropping or contour farming. Conservation tillage, field windbreaks, and winter cover crops help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope, this soil is only moderately suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is IVe. The woodland ordination symbol is 6A (jack pine). The primary forest habitat type is AVDe, and the secondary type is AAt or PAm.

CID—Chetek-Rosholt complex, 12 to 25 percent slopes

These very deep, moderately steep and steep soils are on side slopes and in convex areas on outwash plains and stream terraces. The Chetek soil is somewhat excessively drained, and the Rosholt soil is well drained. Individual areas of this unit are irregularly shaped and generally range from 10 to 80 acres in size. They are 50 to 60 percent Chetek soil and 30 to 40 percent Rosholt soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Chetek soil is very dark grayish brown sandy loam about 10 inches thick. The next layer is dark brown and very pale brown sandy loam about 2 inches thick. The subsoil is about 6 inches thick. It is dark brown and dark yellowish brown, friable sandy loam in the upper part and dark brown, very friable loamy sand in the lower part. The substratum to a depth of 60 inches or more is strong brown, stratified gravelly sand and sand. In some places cobbles are on the surface.

Typically, the surface layer of the Rosholt soil is very dark grayish brown loam about 9 inches thick. The subsurface layer is brown loam about 3 inches thick. The next layer is brown and dark yellowish brown loam about 4 inches thick. The subsoil is about 12 inches thick. It is dark brown, friable loam in the upper part and dark brown, very friable sandy loam in the lower part. The substratum to a depth of 60 inches or more is strong brown, stratified gravelly sand and sand. In some places the surface layer is silt loam. In other places the slope is less than 12 percent or more than 25 percent.

Included with these soils in mapping are small areas of the excessively drained Mahtomedi and Menahga soils. These included soils are sandy throughout. They are in positions on the landscape similar to those of the Chetek and Rosholt soils. They make up 10 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Chetek soil and rapid or very rapid in the substratum. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most plants is limited by droughtiness in the sandy part of the subsoil and in the substratum.

Permeability is moderate or moderately rapid in the loamy mantle of the Rosholt soil and rapid or very rapid in the sandy outwash. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The rooting depth of most crops is limited by droughtiness in the sandy substratum.

Most areas of this unit are used as pasture. A few areas are used as cropland or woodland. Because the hazards of water erosion, droughtiness, and soil blowing are severe or very severe, these soils are generally not suited to cultivated crops. They are poorly suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing, but forage yields are generally low because of the low or moderate available water capacity. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

These soils are suited to trees. The hazard of water erosion, seedling mortality, the equipment limitation, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Ruts form easily on unsurfaced roads during wet periods on the Rosholt soil. Log landings and haul roads can be stabilized with gravel. Competing vegetation interferes with natural regeneration following harvest but can be controlled by herbicides or by mechanical removal.

Because of the slope and a poor filtering capacity, these soils are poorly suited to septic tank absorption fields. The soils readily absorb the effluent in septic tank absorption fields. They do not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, these soils are poorly suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 12 percent.

Because of the slope, these soils are poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is VIe. The woodland ordination symbol is 6R (jack pine) for the Chetek soil and 3R (sugar maple) for the Rosholt soil. The primary forest habitat type is AVDe for the Chetek soil and AAt for the Rosholt soil. The secondary habitat type is AAt for the Chetek soil and ACaCi for the Rosholt soil.

Cm—Comstock silt loam, 0 to 2 percent slopes

This very deep, nearly level, somewhat poorly drained soil is in slightly concave areas and depressions on glacial lake plains. Individual areas are irregularly shaped and generally range from 10 to 50 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 3 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 14 inches thick. The subsoil is dark yellowish brown, mottled, friable silt loam about 14 inches thick. The substratum to a depth of 60 inches or more is yellowish brown, mottled silt loam. In places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the poorly drained Barronett and moderately well drained Crystal Lake soils. Barronett soils are in the lower positions on the landscape. Crystal Lake soils are in the slightly higher positions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Comstock soil and moderately slow in the substratum. The available water capacity is high. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by a perched seasonal high water table, which is at a depth of 1.0 to 2.5 feet in undrained areas.

Most areas are used as cropland. If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Land smoothing, surface drains, diversions, interceptor subsurface drains, and grassed waterways help to remove excess water. If tile drains are installed, silt enters the tile lines unless a suitable filter is used to cover the tile. Applying a system of conservation tillage and returning crop residue to the soil or adding other organic material can help to maintain fertility and good tilth and increase the rate of water infiltration.

This soil is suited to pasture. The surface layer is subject to crusting, which restricts the emergence of the plants. Alfalfa is generally short lived because of the seasonal high water table and the winterkill caused by frost heave. Red clover is generally grown. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel.

Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. On some sites, mounding with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

Because of the wetness, this soil is poorly suited to dwellings. This limitation can be overcome by constructing foundations on coarse textured fill material, such as sand or gravel, above the level of wetness and by installing tile drains around the foundations and providing gravity outlets or other dependable outlets.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement or the base material. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIw. The woodland ordination symbol is 3W (red maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

CsC—Cress-Mahtomedi complex, 6 to 15 percent slopes

These very deep, sloping and moderately steep soils are on ridgetops and side slopes on pitted outwash plains and end moraines. The Cress soil is somewhat excessively drained, and the Mahtomedi soil is excessively drained. Individual areas of this unit are irregularly shaped and generally range from 20 to 200 acres in size. They are 50 to 60 percent Cress soil and 30 to 40 percent Mahtomedi soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Cress soil 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 21 inches thick. It is dark yellowish brown, friable sandy loam in the upper part and dark brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is dark brown, stratified gravelly sand and sand. In places the slope is less than 6 percent or more than 15 percent.

Typically, the surface layer of the Mahtomedi soil is very dark grayish brown loamy sand about 4 inches thick. The subsoil is dark brown sand about 22 inches thick. The substratum to a depth of 60 inches or more is reddish brown, stratified gravelly sand and sand. In places the slope is less than 6 percent or more than 15 percent.

Included with these soils in mapping are small areas of the moderately well drained Haugen soils. Haugen soils have a loamy solum over sandy loam. They are in positions on the landscape similar to those of the Cress and Mahtomedi soils. They make up 10 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Cress soil and rapid or very rapid in the sandy outwash. The available water capacity is low. The content of organic matter is low or moderately low in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most plants is limited by droughtiness in the sandy part of the subsoil and in the substratum.

Permeability is rapid or very rapid in the Mahtomedi soil. The available water capacity is low. The content of organic matter is low in the surface layer. The rooting depth of most plants is limited by droughtiness in the sandy subsoil and in the substratum.

Most areas of this unit are wooded. A few areas are used as pasture. A few areas have been planted to pine trees. Because of water erosion, droughtiness, and soil blowing, these soils are not suited to cultivated crops. They are poorly suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing, but forage yields generally are low because of the low available water capacity. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

These soils are suited to trees. The equipment limitation and seedling mortality are management concerns. Plant competition is an additional concern in areas of the Cress soil. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because of the loose sand in the Mahtomedi soil, equipment with flotation tires or tracks can be operated more easily than other equipment.

Seedling survival can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest on the Cress soil, can be controlled by herbicides or by mechanical removal.

These soils readily absorb the effluent in septic tank absorption fields. They do not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, these soils are only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope, these soils are only moderately suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is VIs. The woodland ordination symbol is 8S (red pine). The primary forest habitat type is AVDe, and the secondary type is PAm.

CsD—Cress-Mahtomedi complex, 15 to 25 percent slopes

These very deep, moderately steep and steep soils are on ridgetops and side slopes on pitted outwash plains and end moraines. The Cress soil is somewhat excessively drained, and the Mahtomedi soil is excessively drained. Individual areas of this unit are irregularly shaped and generally range from 10 to 200 acres in size. They are 45 to 55 percent Cress soil and 30 to 40 percent Mahtomedi soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Cress soil is very dark brown sandy loam about 3 inches thick. The subsoil is about 33 inches thick. It is dark yellowish brown, friable sandy loam in the upper part; dark yellowish brown, very friable loamy sand in the next part; and dark brown, loose gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is reddish brown, stratified gravelly sand and sand. In places the slope is less than 15 percent or more than 25 percent.

Typically, the surface layer of the Mahtomedi soil is very dark grayish brown loamy sand about 4 inches thick. The subsoil is dark brown and reddish brown, very friable sand about 22 inches thick. The substratum to a depth of 60 inches or more is reddish brown, stratified gravelly sand and sand. In places the slope is less than 15 percent or more than 25 percent.

Included with these soils in mapping are small areas of the well drained Amery soils. Amery soils are sandy loam throughout. They are in positions on the landscape similar to those of the Cress and Mahtomedi soils. They make up 10 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Cress soil and rapid or very rapid in the sandy outwash. The available water capacity is very low. The content of organic matter is low or moderately low in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the sandy part of the subsoil and in the substratum.

Permeability is rapid or very rapid in the Mahtomedi soil. The available water capacity is low. The content of organic matter is low in the surface layer. The rooting depth of most plants is limited by droughtiness in the sandy subsoil and in the substratum.

Most areas of this unit are wooded. A few areas have been planted to pine trees. Because of water erosion, droughtiness, and soil blowing, these soils are generally not suited to cultivated crops. They are poorly suited to pasture. A cover of pasture plants is effective in controlling erosion and soil blowing, but forage yields generally are low because of the very low available water capacity. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

These soils are suited to trees. The erosion hazard, the equipment limitation, seedling mortality, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize erosion. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the slope and a poor filtering capacity, these soils are poorly suited to septic tank absorption

fields. The soils readily absorb the effluent from septic tanks. They do not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, these soils are poorly suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be built in areas of included soils where the slope is less than 15 percent.

Because of the slope, these soils are poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is VIIe. The woodland ordination symbol is 8R (red pine). The primary forest habitat type is AVDe, and the secondary type is PAm.

CuA—Crystal Lake silt loam, 0 to 2 percent slopes

This very deep, nearly level, moderately well drained soil is in plane areas on glacial lake plains. Individual areas are irregularly shaped and generally range from 20 to 100 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The next layer is dark brown and brown silt loam about 8 inches thick. The subsoil is dark brown, mottled, friable silt loam about 14 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown, mottled silt loam. In places the surface layer is loam. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Comstock soils. These soils are in the lower positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Crystal Lake soil and moderately slow in the substratum. The available water capacity is very high. The content of organic matter is moderate in the surface layer. The surface layer is friable but tends to crust and puddle after hard rains or if it is tilled when too wet. The depth to a perched seasonal high water table ranges from 2.5 to 3.5 feet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Applying a system of conservation tillage, returning crop residue to the soil, and adding other organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

This soil is suited to pasture. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the moderately slow permeability in the substratum, this soil is poorly suited to septic tank absorption fields. Mounding the site with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

Because of the shrink-swell potential, this soil is only moderately suited to dwellings without basements. This limitation can be overcome by excavating the soil and replacing it with coarse textured material, such as sand or gravel. The wetness is a limitation on sites for dwellings with basements. It can be overcome by constructing foundations on coarse textured fill material above the level of wetness and by installing tile drains around the foundations and providing gravity outlets or other dependable outlets.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement or the base material. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is I. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

CuB—Crystal Lake silt loam, 2 to 6 percent slopes

This very deep, gently sloping, moderately well drained soil is in slightly convex areas on glacial lake plains. Individual areas are irregularly shaped and generally range from 10 to 150 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The next layer is brown and dark brown silt loam about 12 inches thick. The subsoil is dark brown, friable silt loam about 14 inches thick. It is mottled in the lower part. The substratum to a depth of 60 inches or more is brown, mottled silt loam. In some areas the slope is less than 2 percent or more than 6 percent.

Included with this soil in mapping are small areas of the well drained Campia soils. These soils are in the higher positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Crystal Lake soil and moderately slow in the substratum. The available water capacity is very high. The content of organic matter is moderate in the surface layer. The surface layer is friable but tends to crust and puddle after hard rains or if it is tilled when too wet. The depth to a perched seasonal high water table ranges from 2.5 to 3.5 feet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. It can be controlled by terraces, contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation is a management concern. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the moderately slow permeability in the substratum, this soil is poorly suited to septic tank absorption fields. Mounding the site with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

Because of the shrink-swell potential, this soil is only moderately suited to dwellings without basements. This limitation can be overcome by excavating the soil and replacing it with coarse textured material, such as sand or gravel. The wetness is a limitation on sites for dwellings with basements. It can be overcome by constructing foundations on coarse textured fill material above the level of wetness and by installing tile drains around the foundations and providing gravity outlets or other dependable outlets.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement or the base material. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

DoB—Dobie silt loam, 2 to 6 percent slopes

This moderately deep, gently sloping, well drained soil is on ridgetops in the uplands. Individual areas are irregularly shaped and generally range from 5 to 50 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The next layer is dark yellowish brown and brown silt loam about 8 inches thick. The subsoil is about 21 inches thick. It is friable. It is dark yellowish brown silt loam in the upper part, olive brown loam in the next part, and olive very fine sandy loam in the lower part. Glauconitic sandstone is at a depth of about 37 inches. In places the surface layer is 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 Doritty and well drained

Hayriver soils. Doritty soils formed entirely in loess and do not have sandstone within a depth of 60 inches. They are in the lower positions on the landscape. Hayriver soils formed entirely in loamy residuum underlain by glauconitic sandstone or by sandy residuum and glauconitic sandstone. They are in landscape positions similar to those of the Dobie soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Dobie soil and slow to moderate in the sandstone. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by droughtiness in the sandy residuum, where it occurs, and by the underlying sandstone.

Most areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the thin layer of soil over sandstone, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity.

This soil is suited to dwellings. Because of the potential for frost action, it 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 4L (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

DoC2—Dobie silt loam, 6 to 12 percent slopes, eroded

This moderately deep, sloping, well drained soil is on side slopes and ridgetops in the uplands. Individual areas are irregularly shaped and generally range from 5 to 50 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 9 inches thick. The next layer is dark yellowish brown and brown silt loam about 6 inches thick. The subsoil is about 21 inches thick. It is friable. It is dark brown silt loam in the upper part, dark yellowish brown loam in the next part, and strong brown fine sandy loam in the lower part. The substratum is strong brown loamy fine sand about 6 inches thick. Below this to a depth of 60 inches or more is glauconitic sandstone. In places the surface layer is loam. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the well drained Hayriver and Wickware soils. Hayriver soils formed in loamy residuum underlain by glauconitic sandstone or by sandy residuum and glauconitic sandstone. Wickware soils formed entirely in loess and do not have sandstone within a depth of 60 inches. Hayriver soils are in positions on the landscape similar to those of the Dobie soil. Wickware soils are in the lower landscape positions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Dobie soil and slow to moderate in the sandstone. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by droughtiness in the sandy residuum, where it occurs, and by the underlying sandstone.

Most areas are used as cropland or pasture. This

soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the thin layer of soil over sandstone, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the potential for 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 IIIe. The woodland ordination symbol is 4L (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

DoD2—Dobie silt loam, 12 to 20 percent slopes, eroded

This moderately deep, moderately steep, well drained soil is on side slopes in the uplands. Individual areas are irregularly shaped and generally range from 5 to 20 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 7 inches thick. The subsoil is about 26 inches thick. It is friable. It is dark yellowish brown and dark brown silt loam in the upper part and dark yellowish brown loam in the lower part. The substratum is brownish yellow sand about 5 inches thick. Below this to a depth of 60 inches or more is glauconitic sandstone. In places the surface layer is loam. In some areas the slope is less than 12 percent or more than 20 percent.

Included with this soil in mapping are small areas of the well drained Hayriver and Wickware soils. Hayriver soils formed in loamy residuum underlain by glauconitic sandstone or by sandy residuum and glauconitic sandstone. Wickware soils formed entirely in loess and do not have sandstone within a depth of 60 inches. Hayriver soils are in positions on the landscape similar to those of the Dobie soil. Wickware soils are in the lower landscape positions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Dobie soil and slow to moderate in the sandstone. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by droughtiness in the sandy substratum, where it occurs, and by the underlying sandstone.

Most areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants.

Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, the equipment limitation, the windthrow hazard, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the slope and the thin layer of soil over sandstone, this unit is generally unsuited to septic tank absorption fields.

Because of the slope, this soil is poorly suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 12 percent.

Because of the slope and the potential for frost action, this soil is poorly suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is IVe. The woodland ordination symbol is 4R (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

DrB—Doritty silt loam, 2 to 6 percent slopes

This very deep, gently sloping, moderately well drained soil is on footslopes of valley sides. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is dark brown and brown silt loam about 6 inches thick. The subsoil is dark brown, friable silt loam about 20 inches thick. It is mottled in the lower part. The substratum to a depth of 60 inches or more is dark yellowish brown silt loam. In places the surface layer is thicker and darker.

Included with this soil in mapping are small areas of the well drained Anigon and Wickware soils. Anigon soils are underlain by sand and gravel. They are in positions on the landscape similar to those of the Doritty soil. Wickware soils are in the slightly higher positions on the landscape. Included soils make up 2 to 5 percent of the unit.

Permeability is moderate in the Doritty soil. The available water capacity is very high. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The depth to a perched seasonal high water table ranges from 3.5 to 6.0 feet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. It can be controlled by terraces, contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation

and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness, this soil is poorly suited to septic tank absorption fields. Mounding the site with suitable filtering material helps to overcome the wetness. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

This soil is suited to dwellings without basements, but it is only moderately suited to dwellings with basements because of the wetness. The wetness can be overcome by constructing the foundations on coarse textured fill material, such as sand or gravel, above the level of wetness and by installing tile drains around the foundations and providing gravity outlets or other dependable outlets.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. These limitations can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel; by increasing the thickness of the pavement or the base material; and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIe. The woodland ordination symbol is 5L (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

Fm—Fordum silt loam, 0 to 2 percent slopes

This very deep, nearly level, poorly drained soil is in plane or slightly concave areas on flood plains. It is subject to ponding and is frequently flooded for brief or long periods. Individual areas are long and narrow and generally range from 10 to 80 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The upper 13 inches of the substratum is dark grayish brown, mottled silt loam with a few thin strata of very fine sand. The next 6 inches is dark brown, mottled sandy loam. The lower part of the substratum to a depth of 60 inches or more is dark brown gravelly sand. In places the surface layer is loam. In some areas layers of organic material are in the substratum.

Included with this soil in mapping are small areas of the moderately well drained Moppet soils. These soils formed in loamy alluvium underlain by sandy alluvium. They are in the slightly higher positions on the flood plains. They make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the silty and loamy mantle of the Fordum soil and rapid or very rapid in the sandy substratum. The available water capacity is moderate. The content of organic matter is high or very high in the surface layer. The rooting depth of most crops is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas support wetland vegetation. Because of the wetness, a scarcity of suitable drainage outlets, and the flooding, this soil generally is not suited to cultivated crops. It is poorly suited to pasture unless it is drained and protected from flooding. Establishing or maintaining improved pasture is difficult because of the wetness. Grazing is limited to short periods when the soil is dry. The native vegetation is generally of poor quality for forage.

This soil is suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Because of the wetness, planting on prepared ridges generally is needed if natural regeneration is unreliable. Selecting vigorous nursery stock for planting reduces the seedling mortality rate. Planting and harvesting are limited during periods of flooding. Seedling mortality may be high unless the soil is protected from flooding. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the flooding and the ponding. Overcoming these limitations is difficult. A better suited site should be considered.

The land capability classification is VIw. The woodland ordination symbol is 2W (silver maple). A forest habitat type has not been assigned.

FnB—Freeon silt loam, 2 to 6 percent slopes

This gently sloping, moderately well drained soil is in plane or slightly convex areas on moraines. It is

deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 5 to 60 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next 12 inches is brown and dark yellowish brown, mottled silt loam. Below this is 20 inches of dark brown and brown, mottled sandy loam. The subsoil is dark reddish brown, mottled, friable sandy loam about 46 inches thick. The substratum to a depth of 99 inches or more is reddish brown, firm sandy loam. In some places the surface layer is loam. In a few places cobbles are on the surface. In some areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Magnor and well drained Santiago soils. Magnor soils are in the slightly lower positions on the landscape. Santiago soils are in the slightly higher positions. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the silty mantle of the Freeon soil, slow or moderately slow in the loamy lower part of the subsoil, and very slow in the substratum. The available water capacity is high. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The depth to a perched seasonal high water table ranges from 2.0 to 3.5 feet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. It can be controlled by contour farming, contour stripcropping, conservation tillage, and diversions. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the restricted permeability in the lower part of the subsoil and in the substratum, this soil is poorly suited to septic tank absorption fields. Mounding the site with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

Because of the wetness, this soil is only moderately suited to dwellings without basements and is poorly suited to dwellings with basements. This limitation can be overcome by constructing foundations on coarse textured fill material, such as sand or gravel, above the level of wetness and by installing tile drains around the foundations and providing gravity outlets or other dependable outlets.

Because of the wetness and the potential for frost action, this soil is only moderately suited to local roads and streets. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by wetness. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIe. The woodland ordination symbol is 3L (sugar maple). The primary forest type habitat type is ACaCi, and the secondary type is AAt.

FnC2—Freeon silt loam, 6 to 12 percent slopes, eroded

This sloping, moderately well drained soil is on side slopes and knolls on moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is very dark grayish brown silt loam about 9 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 11 inches thick. The subsoil is about 25 inches thick. It is mottled. The upper part is dark brown, friable loam, and the lower part is reddish brown, firm sandy loam. The substratum to a depth of 60 inches or more is dark reddish brown, firm sandy loam. In some places the surface layer is loam. In other places cobbles are on the surface. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of

the well drained Amery and Santiago soils in the higher positions on the landscape. Amery soils are sandy loam throughout. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the silty mantle of the Freeon soil, slow or moderately slow in the loamy lower part of the subsoil, and very slow in the substratum. The available water capacity is high. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The depth to a perched seasonal high water table ranges from 2.0 to 3.5 feet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by contour farming, contour stripcropping, conservation tillage, and diversions. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the restricted permeability in the lower part of the subsoil and in the substratum, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

Because of the wetness and the slope, this soil is only moderately suited to dwellings without basements. Because of the wetness, it is poorly suited to dwellings with basements. The wetness can be overcome by installing tile drains around foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on coarse textured fill material, such as sand or gravel, above the level of wetness. The slope can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the wetness, the slope, and the potential for frost action, this soil is only moderately suited to local roads and streets. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by wetness. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

FrA—Friendship loamy sand, 0 to 3 percent slopes

This very deep, nearly level and gently sloping, moderately well drained soil is in plane or slightly concave areas on outwash plains. Individual areas are irregularly shaped and generally range from 5 to 80 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is about 18 inches thick. It is dark yellowish brown, very friable loamy sand in the upper part and dark brown, very friable sand in the lower part. The substratum to a depth of 60 inches or more is strong brown, mottled sand. In places the surface layer is sand, loamy fine sand, or fine sandy loam. In some areas loamy strata are in the subsoil and substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Meehan and excessively drained Menahga soils. Meehan soils are in the slightly lower positions on the landscape. Menahga soils are in positions similar to or slightly higher than those of the Friendship soil. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Friendship soil. The available water capacity is low. The content of organic

matter is low or moderately low in the surface layer. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the sandy subsoil and substratum unless water is available from the seasonal high water table. The depth to an apparent seasonal high water table ranges from 3.5 to 6.0 feet.

Most areas are used as cropland. Some areas have been planted to pine trees. This soil is poorly suited to corn and small grain and to grasses and legumes for hay and pasture because of the low available water capacity. If irrigated, however, the soil is suited to the commonly grown farm crops and to vegetables, such as snap beans, potatoes, sweet corn, and peas. If cultivated crops are grown, the soil is subject to soil blowing. Winter cover crops, conservation tillage, wind stripcropping, and field windbreaks help to prevent excessive soil loss. Returning crop residue to the soil or adding other organic material reduces the amount of water lost through evaporation, increases the rate of water infiltration, helps to maintain fertility, and reduces the susceptibility to soil blowing.

A cover of pasture plants is effective in controlling soil blowing. Forage yields are generally low unless fertilizer is applied and the soil receives an adequate amount of moisture. Planting early in spring, before the soil has a chance to dry out, helps to overcome the droughtiness. Planting later in the year is likely to result in a poor survival rate. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Seedling mortality is a management concern. Seedling survival can be improved by careful planting of vigorous nursery stock.

This soil readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid permeability. The poor filtering capacity can result in the pollution of ground water. The wetness also is a limitation. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

This soil is suited to local roads and streets and to dwellings without basements. Because of the wetness, however, it is only moderately suited to dwellings with basements. This limitation can be overcome by installing tile drains around foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on course textured fill material, such as sand or gravel, above the level of wetness.

The land capability classification is IVs in nonirrigated areas and IIs in irrigated areas. The woodland ordination symbol is 6S (jack pine). The primary forest habitat type is PAm, and the secondary type is QGCe.

Gr—Greenwood peat, 0 to 1 percent slopes

This very deep, nearly level, very poorly drained soil is in depressions on ground moraines and outwash plains. It is subject to ponding. Individual areas are irregularly shaped and generally range from 10 to 100 acres in size.

Typically, the organic material is at least 60 inches thick. The upper part is yellowish brown peat, and the lower part is dark yellowish brown, dark brown, and dark reddish brown mucky peat and muck.

Included with this soil in mapping are small areas of the very poorly drained Seelyeville soils. These soils typically are mucky material. They are in positions on the landscape similar to those of the Greenwood soil. They make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the Greenwood soil. The available water capacity is very high. The content of organic matter also is very high. The rooting depth of most plants is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas support wetland vegetation. Because of the wetness, a scarcity of suitable drainage outlets, the hazard of frost in late spring or early fall, and an extremely acid reaction, this soil is generally not suited to cultivated crops or pasture. If drained, it is subject to burning and subsidence. Also, it is subject to soil blowing.

Because of the extremely acid condition and the high water table, this soil is generally unsuited to trees. The trees grow so poorly and are so poorly shaped that they are barely merchantable at best.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the ponding. Overcoming this hazard is difficult. A better suited site should be considered.

The land capability classification is VIIw in undrained areas. The woodland ordination symbol is 2W (black spruce). A forest habitat type has not been assigned.

HaB—Haugen sandy loam, 2 to 6 percent slopes

This gently sloping, moderately well drained soil is on ridgetops on moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 5 to 100 acres in size.

Typically, the surface layer is dark brown sandy loam about 6 inches thick. The subsoil is about 42 inches thick. The upper part is dark yellowish brown, friable sandy loam; the next part is brown and dark brown, friable sandy loam; and the lower part is strong brown, mottled, very friable gravelly sandy loam. The substratum to a depth of 60 inches or more is reddish brown, firm gravelly sandy loam. In places cobblestones are on the surface. In a few areas the surface layer is loam or silt loam. In some places the slope is more than 6 percent.

Included with this soil in mapping are small areas of the very poorly drained Adolph and somewhat poorly drained Magnor soils. Adolph soils are in depressions and drainageways. Magnor soils are in concave areas and drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the subsoil in the Haugen soil, moderate or moderately slow in the lower part of the subsoil, and very slow in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The depth to a perched seasonal high water table ranges from 2.5 to 3.5 feet.

Most areas are wooded. A few areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. Also, the soil is subject to soil blowing. Most areas have slopes that are too short and irregular for stripcropping, terraces, or contour farming. Conservation tillage and winter cover crops help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the slow permeability in the substratum, this soil is poorly suited to septic tank absorption fields. Mounding the site with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

This soil is suited to dwellings without basements. Because of the wetness, however, it is only moderately suited to dwellings with basements. This limitation can be overcome by installing tile drains around the foundations and providing gravity outlets or other dependable outlets and by constructing foundations on coarse textured fill material, such as sand or gravel, above the level of wetness.

Because of the potential for frost action, this soil is only moderately suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is AAt, and the secondary type is AVDe.

HaC—Haugen sandy loam, 6 to 12 percent slopes

This sloping, moderately well drained soil is on ridgetops and side slopes on moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 10 to 200 acres in size.

Typically, the surface layer is very dark brown sandy loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown, friable sandy loam and gravelly sandy loam about 19 inches thick. Below this is about 26 inches of dark reddish brown and reddish brown, mottled, friable sandy loam and gravelly sandy loam. The lower part of the subsoil is about 30 inches thick. It is reddish brown, mottled, friable gravelly loamy sand in the upper part and dark reddish brown, firm gravelly sandy loam in the lower part. The substratum to a depth of 88 inches or more is reddish brown, firm gravelly sandy loam. In places

the surface layer is loam or silt loam. In some areas cobblestones are on the surface. In other areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the very poorly drained Adolph, well drained Amery, and somewhat poorly drained Magnor soils. Adolph soils are in depressions. Amery soils are in the higher positions on the landscape. Magnor soils are in concave areas and drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the subsoil in the Haugen soil, moderate or moderately slow in the lower part of the subsoil, and very slow in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The depth to a perched seasonal high water table ranges from 2.5 to 3.5 feet.

Most areas are wooded. A few areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. Also, the soil is subject to soil blowing. Most areas have slopes that are too short and irregular for stripcropping or contour farming. Conservation tillage and winter cover crops help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the slow permeability in the substratum, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

Because of the slope, this soil is only moderately suited to dwellings without basements. Because of the wetness and the slope, it is only moderately suited to dwellings with basements. The wetness can be overcome by installing tile drains around foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on coarse textured fill material, such as sand or gravel, above the level of wetness. The slope can be overcome by cutting and filling, installing retaining walls, or designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope and the potential for frost action, this soil is only moderately suited to local roads and streets. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is AAt, and the secondary type is AVDe.

HgC—Haugen-Greenwood complex, 0 to 15 percent slopes

These soils are on moraines. The moderately well drained, sloping and moderately steep Haugen soil is deep or very deep to dense till. It has slopes of 6 to 15 percent and is on ridgetops and side slopes. In most areas it has stones on the surface. The nearly level, very deep, very poorly drained Greenwood soil is in depressions and has slopes of 0 to 1 percent. It is subject to ponding. Individual areas of this unit are irregularly shaped and generally range from 100 to 300 acres in size. They are 55 to 65 percent Haugen soil and 20 to 30 percent Greenwood soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Haugen soil is very dark brown sandy loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown, friable sandy loam about 19 inches thick. Below this is about 26 inches of dark reddish brown and reddish brown, mottled, friable sandy loam. The lower part of the subsoil is about 30 inches thick. It is reddish brown, friable gravelly sandy loam in the upper part

and dark reddish brown, firm sandy loam in the lower part. The substratum to a depth of 88 inches or more is dark reddish brown, firm sandy loam. In places the surface layer is loam. In some areas cobblestones are on the surface. In other areas the slope is less than 6 percent or more than 15 percent.

Typically, the organic material in the Greenwood soil is at least 60 inches thick. The upper part is yellowish brown peat, and the lower part is dark yellowish brown, dark brown, and dark reddish brown mucky peat.

Included with these soils in mapping are small areas of the very poorly drained Adolph, well drained Amery, and somewhat poorly drained Magnor soils. Adolph and Magnor soils formed in silty and loamy deposits over sandy loam till. Adolph soils are in positions on the landscape similar to those of the Greenwood soil. Magnor soils are in positions slightly lower than those of the Haugen soil. Amery soils are slightly higher on the landscape than the Haugen soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the subsoil in the Haugen soil, moderate or moderately slow in the lower part of the subsoil, and very slow in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The depth to a perched seasonal high water table ranges from 2.5 to 3.5 feet.

Permeability is moderate or moderately rapid in the Greenwood soil. The available water capacity is very high. The content of organic matter also is very high. The rooting depth of most plants is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas of this unit are wooded. The Haugen soil is generally unsuited to corn and small grain and to grasses and legumes for hay and pasture because of the stones on the surface. Removing these stones is difficult and costly.

Because of the wetness, a scarcity of suitable drainage outlets, the hazard of frost in late spring or early fall, and an extremely acid reaction, the Greenwood soil is generally not suited to cultivated crops or pasture. If drained and cultivated, it is subject to burning and subsidence. Also, it is subject to soil blowing.

The Haugen soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the extremely acid condition and the high water table, the Greenwood soil is generally unsuited to trees. The trees grow so poorly and are so poorly shaped that they are barely merchantable at best.

Because of the wetness and the slow permeability in the substratum, the Haugen soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

Because of the slope, the Haugen soil is only moderately suited to dwellings without basements. Because of the wetness and the slope, it is only moderately suited to dwellings with basements. The wetness can be overcome by installing tile drains around foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on coarse textured fill material, such as sand or gravel, above the level of wetness. The slope can be overcome by cutting and filling, installing retaining walls, or designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope and the potential for frost action, the Haugen soil is only moderately suited to local roads and streets. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The Greenwood soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the ponding. Overcoming this hazard is difficult. A better suited site should be considered.

The land capability classification is VIs. The woodland ordination symbol is 3L (sugar maple) for the Haugen soil and 2W (black spruce) for the Greenwood soil. The primary forest habitat type for the Haugen soil is AAt, and the secondary type is AVDe. A forest habitat type has not been assigned for the Greenwood soil.

HvC2—Hayriver fine sandy loam, 6 to 12 percent slopes, eroded

This moderately deep, sloping, well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregularly shaped and generally range from 5 to 50 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is brown fine sandy loam about 5 inches thick. The subsoil is dark yellowish brown, friable fine sandy loam about 17 inches thick. Below this to a depth of 60 inches or more is fine grained glauconitic sandstone. In places the depth to sandstone is less than 20 inches. In a few areas the surface layer is sandy loam or loam. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the well drained Dobie soils. These soils formed in loess and loamy residuum over sandstone. They are in the higher positions on the landscape. They make up 5 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the subsoil of the Hayriver soil and slow to moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the sandy substratum, where it occurs, and by the underlying sandstone.

Most areas are used as cropland or pasture. A few areas are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, water erosion is a moderate hazard. Also, soil blowing is a hazard. Contour farming, contour stripcropping, and conservation tillage help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the thin layer of soil over sandstone, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope and the potential for frost action, this soil is only moderately suited to local roads and streets. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required. The road damage caused by frost action can be minimized 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 4A (northern red oak). The primary forest habitat type is AVDe, and the secondary type is AAt.

HvD—Hayriver fine sandy loam, 12 to 20 percent slopes

This moderately deep, moderately steep, well drained soil is on side slopes in the uplands. Individual areas are irregularly shaped and generally range from 5 to 40 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 5 inches thick. The subsoil is about 19 inches thick. It is dark brown, friable sandy loam in the upper part and dark brown, very friable loamy sand in the lower part. The substratum is yellowish brown sand about 14 inches thick. Weakly cemented sandstone is at a depth of about 38 inches. In places the surface layer is sandy loam or loam. In some

areas, the soil is severely eroded and the dark brown subsoil is exposed. In other areas the slope is less than 12 percent or more than 20 percent.

Included with this soil in mapping are small areas of the excessively drained Twinmound soils. These soils are sandy throughout. They are in positions on the landscape similar to those of the Hayriver soil. They make up 5 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the subsoil of the Hayriver soil and slow to moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the sandy substratum, where it occurs, and by the underlying sandstone.

Most areas are used as pasture. A few areas are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, water erosion is a severe hazard. Also, soil blowing is a hazard. Contour farming, contour stripcropping, crop rotations that include grasses and legumes, and conservation tillage help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, the equipment limitation, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation interferes with natural regeneration following harvest but can be controlled by herbicides or by mechanical removal.

Because of the slope and the thin layer of soil over sandstone, this unit is generally unsuited to septic tank absorption fields.

Because of the slope, this soil is poorly suited to dwellings. This limitation can be overcome by cutting and filling or by installing retaining walls. Also, the dwellings can be designed so that one side of the basement fronts on the lower part of the slope.

Because of the slope, this soil is poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is IVe. The woodland ordination symbol is 4R (northern red oak). The primary forest habitat type is AVDe, and the secondary type is AAt.

HyB—Hayriver loam, 2 to 6 percent slopes

This moderately deep, gently sloping, well drained soil is on ridgetops in the uplands. Individual areas are irregularly shaped and generally range from 5 to 40 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The subsoil is dark brown, friable loam about 18 inches thick. Weakly cemented sandstone is at a depth of about 30 inches. In places the surface layer is fine sandy loam or sandy loam.

Included with this soil in mapping are small areas of the well drained Arland and Dobie soils. These soils are in positions on the landscape similar to those of the Hayriver soil. Arland soils formed in loess and loamy glacial till over sandstone or over sandy residuum and sandstone. Dobie soils formed in loess and loamy residuum over sandstone. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the subsoil of the Hayriver soil and slow to moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the sandy substratum, where it occurs, and by the underlying sandstone.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown,

water erosion is a slight or moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the thin layer of soil over sandstone, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity.

This soil is suited to dwellings. Because of the potential for frost action, it is only moderately suited to local roads and streets. The road damage caused by frost action can be minimized 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 4A (northern red oak). The primary forest habitat type is AVDe, and the secondary type is AAt.

HzF—Hayriver-Twinmound complex, 20 to 50 percent slopes

These moderately deep, steep and very steep, well drained and excessively drained soils are on side slopes in the uplands. Individual areas of this unit are irregularly shaped and generally range from 40 to 200 acres in size. They are 50 to 60 percent Hayriver soil and 25 to 35 percent Twinmound soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Hayriver soil is dark brown fine sandy loam about 6 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 2 inches thick. The subsoil is about 32 inches thick. It is dark yellowish brown, friable sandy loam and fine sandy loam in the upper part; olive gray, friable loam in the next part; and olive gray, friable fine sandy loam in the lower part. Fine grained glauconitic sandstone is at a depth of about 36 inches.

Typically, the surface layer of the Twinmound soil is dark brown sand about 4 inches thick. The subsoil is about 24 inches thick. It is dark yellowish brown and dark brown, very friable sand in the upper part and strong brown, loose sand in the lower part. Weakly cemented sandstone is a depth of about 28 inches. It grades to strongly cemented sandstone at a depth of about 42 inches. In some areas the slope is less than 20 percent.

Included with these soils in mapping are small areas of soils in which the depth to bedrock is less than 20 inches. Also included are small areas of sandstone rock outcrop. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the subsoil of the Hayriver soil and slow to moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low in the surface layer. The rooting depth of most plants is limited by droughtiness in the sandy substratum, where it occurs, and by the underlying sandstone.

Permeability is rapid in the subsoil of the Twinmound soil and moderately slow or moderate in the sandstone. The available water capacity is very low. The content of organic matter is low in the surface layer. The rooting depth of most plants is limited by the underlying sandstone.

Most areas of this unit are wooded. Because of the severe or very severe hazard of water erosion, these soils are not suited to cultivated crops. They are poorly suited to improved pasture because of the hazard of water erosion and the slope, which limits the use of machinery. In some of the less sloping areas, the pasture can be renovated and improved. The native vegetation generally is of poor quality for forage.

These soils are suited to trees. The hazard of water erosion, the equipment limitation, and seedling mortality are management concerns. The windthrow hazard is an additional concern on the Twinmound soil, and plant competition is a concern on the Hayriver soil. Hand planting, contour planting, and careful selection of sites for access roads help to control water erosion. The use of equipment is limited by the slope, by the loose sand in the Twinmound soil, and by low strength of the Hayriver soil. Ruts form easily on unsurfaced roads in areas of the Hayriver soil during wet periods. Log landings and haul roads

can be stabilized with gravel. The sandy surface of the Twinmound soil can interfere with the traction of wheeled equipment, especially during dry periods. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees on the Twinmound soil. Competing vegetation, which interferes with natural regeneration following harvest on the Hayriver soil, can be controlled by herbicides or by mechanical removal.

These soils are generally unsuited to use as sites for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the slope. Overcoming this limitation is difficult. A better suited site should be considered.

The land capability classification is VIIe. The woodland ordination symbol is 4R (northern red oak) for the Hayriver soil and 4R (jack pine) for the Twinmound soil. The primary forest habitat type for the unit is AVDe, and the secondary type is AAt.

MaB—Magnor silt loam, 0 to 4 percent slopes

This nearly level and gently sloping, somewhat poorly drained soil is in plane or slightly concave areas and in drainageways on moraines. It is deep to dense till. Individual areas are irregularly shaped and generally range from 10 to 100 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 2 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 14 inches thick. The subsoil is reddish brown, mottled, friable sandy loam about 26 inches thick. The substratum to a depth of 60 inches or more is reddish brown, firm sandy loam. In places the surface layer is loam. In some areas the slope is more than 4 percent.

Included with this soil in mapping are small areas of the moderately well drained Freeon soils. These soils are in the higher positions on the landscape. They make up 5 to 15 percent of the unit.

Permeability is moderate in the silty mantle of the Magnor soil. It is moderately slow or slow in the loamy lower part of the subsoil and very slow in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by a perched seasonal high water table, which is at a depth of 1.0 to 2.5 feet in undrained areas.

Most areas are used as cropland. A few areas are used as pasture or woodland. If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight hazard. It can be controlled by using a system of conservation tillage and planting winter cover crops. Land smoothing, surface drains, grassed waterways, and diversions help to remove excess water. Returning crop residue to the soil or adding other organic material helps to maintain fertility and tilth, increases the rate of water infiltration, and helps to control water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Alfalfa is generally short lived because of the seasonal high water table and the winterkill caused by frost heave. Red clover is generally grown. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. Wetness and low soil strength generally limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the restricted permeability in the lower part of the subsoil and in the substratum, this soil is poorly suited to septic tank absorption fields. On some sites, mounding with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

Because of the wetness, this soil is poorly suited to

dwellings. This limitation can be overcome by constructing foundations on coarse textured fill material, such as sand or gravel, above the level of wetness and by installing tile drains around the foundations and providing gravity outlets or other dependable outlets.

Because of the potential for frost action, this soil is poorly suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIw. The woodland ordination symbol is 3W (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

Me—Markey muck, 0 to 1 percent slopes

This very deep, nearly level, very poorly drained soil is in depressions and drainageways on outwash plains. It is subject to ponding. Individual areas are elongated and generally range from 20 to 80 acres in size.

Typically, the upper 44 inches is black muck. The substratum to a depth of 60 inches or more is olive gray sand. In some areas the organic material has strata of peat or mucky peat. In other areas it is less than 16 inches thick over sand.

Included with this soil in mapping are small areas of the poorly drained and very poorly drained Fordum and Rib soils. These soils are in the slightly higher areas. Fordum soils are stratified and typically are silty in the upper part. Rib soils formed in silty alluvium over sand and gravel. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic part of the Markey soil and rapid in the substratum. The available water capacity is very high. The content of organic matter also is very high. The rooting depth of most plants is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas support wetland vegetation. A few areas have been drained and are used as cropland. Because of the wetness, a scarcity of suitable drainage outlets, and the hazard of frost in late spring or early fall, this soil is generally not suited to cultivated crops or pasture. If drained and cultivated, it is subject to burning and subsidence. Also, it is subject to soil blowing.

Because of the high water table, this soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Wetness and low soil strength generally limit access by machinery to periods when the soil is frozen or snow cover is thick. Reforestation is typically limited to natural regeneration. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the ponding. Overcoming this hazard is difficult. A better suited site should be considered.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 2W (quaking aspen). A forest habitat type has not been assigned.

Mh—Meehan loamy sand, 0 to 2 percent slopes

This very deep, nearly level, somewhat poorly drained soil is in shallow depressions on outwash plains. Individual areas are elongated and generally range from 5 to 20 acres in size.

Typically, the surface layer is black loamy sand about 5 inches thick. The subsurface layer is brown loamy sand about 3 inches thick. The subsoil is about 20 inches thick. It is dark brown and dark yellowish brown, mottled, very friable or loose sand. The substratum to a depth of 60 inches or more is dark brown, mottled sand. In places the substratum has strata of loamy sand less than 1 inch thick.

Included with this soil in mapping are small areas of the moderately well drained Friendship and poorly drained and very poorly drained Newson soils. Friendship soils are in the slightly higher positions on the landscape. Newson soils are in the lower positions. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Meehan soil. The available water capacity is low. The content of organic matter is low to moderate in the surface layer. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by an apparent seasonal high water table, which is at a depth of 1.0 to 2.5 feet in undrained areas.

Most areas are used as cropland. A few areas are used as pasture. If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Excess water can be removed by

diversions, grassed waterways, surface drains, and drainage tile. If the water table is excessively lowered, however, crop yields in most years are limited by the low available water capacity. If tile drains are installed, the finer sand enters the tile lines unless a suitable filter covers the tile. In areas that are cultivated, soil blowing is a hazard. It can be controlled by wind stripcropping, field windbreaks, and conservation tillage. Returning crop residue to the soil or adding other organic material reduces the hazard of soil blowing and the amount of water lost through evaporation, increases the rate of water infiltration, and helps to maintain fertility.

A cover of pasture plants is effective in controlling soil blowing. Forage yields are generally low unless fertilizer is applied and an adequate amount of moisture is supplied either through a controlled drainage system or through irrigation. Alfalfa is short lived unless the soil is drained. Red clover is generally grown. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, restricted use during wet periods, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. Wetness frequently limits access by machinery to the dry summer months or to periods when the soil is frozen or snow cover is thick. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid permeability. The poor filtering capacity can result in the pollution of ground water. The wetness also is a limitation.

Because of the wetness, this soil is poorly suited to dwellings. This limitation can be overcome by installing tile drains around foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on coarse textured fill material, such as sand or gravel, above the level of wetness.

Because of the wetness and the potential for frost action, this soil is only moderately suited to local roads and streets. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by wetness. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IVw. The woodland ordination symbol is 5W (jack pine). The primary forest habitat type is PAm.

MnA—Menahga loamy sand, 0 to 2 percent slopes

This very deep, nearly level, excessively drained soil is in plane areas on outwash plains. Individual areas are irregularly shaped and generally range from 10 to 60 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 12 inches thick. The subsoil is dark yellowish brown, dark brown, and strong brown, very friable sand about 20 inches thick. The substratum to a depth of 60 inches or more is yellowish brown sand. In places the surface layer is loamy fine sand or sand. In some areas the substratum is gravelly sand or has loamy or silty strata.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek and moderately well drained Friendship soils. Chetek soils formed in loamy alluvium and in the underlying sandy outwash. They are in the slightly higher positions on the landscape. Friendship soils are in the slightly lower positions. Included soils make up 2 to 10 percent of the unit.

Permeability is rapid in the Menahga soil. The available water capacity is low. The content of organic matter is low or moderately low in the surface layer. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness.

Most areas are used as cropland. Some areas have been planted to pine trees. This soil is poorly suited to corn and small grain and to grasses and legumes for hay and pasture because of the low available water capacity. If irrigated, however, it is suited to the commonly grown farm crops and to vegetables, such as snap beans, potatoes, sweet corn, and peas. If cultivated crops are grown, the soil is subject to soil blowing. Winter cover crops, conservation tillage, wind stripcropping, and field windbreaks help to prevent excessive soil loss. Returning crop residue to the soil or adding other organic material reduces the hazard of soil blowing and the amount of water lost through evaporation, increases the rate of water infiltration, and helps to maintain fertility.

A cover of pasture plants is effective in controlling

soil blowing. Forage yields are generally low unless fertilizer is applied and the supply of moisture is adequate. Planting early in spring, before the soil has a chance to dry out, helps to overcome the droughtiness. Planting later in the year is likely to result in a poor survival rate. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Seedling mortality is a management concern. Seedling survival can be improved by careful planting of vigorous nursery stock.

This soil is suited to dwellings and to local roads and streets. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid permeability. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs in nonirrigated areas and IIs in irrigated areas. The woodland ordination symbol is 7S (jack pine). The primary forest habitat type is PAm, and the secondary type is QGCe.

MnB—Menahga loamy sand, 2 to 6 percent slopes

This very deep, gently sloping, excessively drained soil is in plane or slightly convex areas on outwash plains. Individual areas are irregularly shaped and generally range from 10 to 80 acres in size.

Typically, the surface layer is very dark brown loamy sand about 10 inches thick. The subsoil is about 28 inches thick. It is very friable sand. It is dark yellowish brown in the upper part and dark brown in the lower part. The substratum to a depth of 60 inches or more is yellowish brown sand. In places the surface layer is loamy fine sand or sand. In some areas the substratum is gravelly sand or has loamy or silty strata. In other areas the slope is less than 2 percent or more than 6 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek and moderately well drained Friendship soils. Chetek soils formed in loamy alluvium and in the underlying sandy outwash. They are in the slightly higher positions on the landscape. Friendship soils are in the slightly lower positions. Included soils make up 2 to 10 percent of the unit.

Permeability is rapid in the Menahga soil. The available water capacity is low. The content of organic matter is low or moderately low in the surface layer. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness.

Most areas are used as cropland. Some areas have been planted to pine trees. This soil is poorly suited to corn and small grain and to grasses and legumes for hay and pasture because of the low available water capacity. If irrigated, however, it is suited to the commonly grown farm crops and to vegetables, such as snap beans, potatoes, sweet corn, and peas. If cultivated crops are grown, water erosion is a slight hazard. Also, the soil is subject to soil blowing. Winter cover crops, conservation tillage, wind stripcropping, and field windbreaks help to prevent excessive soil loss. Returning crop residue to the soil or adding other organic material reduces the hazard of soil blowing and the amount of water lost through evaporation, increases the rate of water infiltration, and helps to maintain fertility.

A cover of pasture plants is effective in controlling soil blowing and water erosion. Forage yields are generally low unless fertilizer is applied and the supply of moisture is adequate. Planting early in spring, before the soil has a chance to dry out, helps to overcome the droughtiness. Planting later in the year is likely to result in a poor survival rate. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. Seedling mortality is a management concern. Seedling survival can be improved by careful planting of vigorous nursery stock.

This soil is suited to dwellings and to local roads and streets. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid permeability. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs in nonirrigated areas and IIIe in irrigated areas. The woodland ordination symbol is 7S (jack pine). The primary forest habitat type is PAm, and the secondary type is QGCe.

MnC—Menahga loamy sand, 6 to 12 percent slopes

This very deep, sloping, excessively drained soil is on side slopes and in convex areas on outwash plains. Individual areas are irregularly shaped and generally range from 5 to 40 acres in size.

Typically, the surface layer is dark brown loamy

sand about 8 inches thick. The subsoil is dark brown, very friable and loose sand about 18 inches thick. The substratum to a depth of 60 inches or more is strong brown sand. In places the substratum is gravelly sand or has loamy or silty strata. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek soils. These soils formed in loamy alluvium and in the underlying sandy outwash. They are in positions on the landscape similar to those of the Menahga soil. They make up 2 to 10 percent of the unit.

Permeability is rapid in the Menahga soil. The available water capacity is low. The content of organic matter is low or moderately low in the surface layer. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness.

Most areas are wooded. Some areas have been planted to pine trees. A few areas are used as cropland. This soil is poorly suited to corn and small grain and to grasses and legumes for hay and pasture. In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, water erosion is a moderate hazard. Also, the soil is subject to soil blowing. Winter cover crops, wind stripcropping, conservation tillage, and field windbreaks help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material reduces the hazard of soil blowing and the amount of water lost through evaporation, increases the rate of water infiltration, and helps to maintain fertility.

A cover of pasture plants is effective in controlling soil blowing and water erosion. Forage yields are generally low unless fertilizer is applied and the supply of moisture is adequate. Planting early in spring, before the soil has a chance to dry out, helps to overcome the droughtiness. Planting later in the year is likely to result in a poor survival rate. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and seedling mortality are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Seedling survival can be improved by careful planting of vigorous nursery stock.

This soil readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid permeability. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope, this soil is only moderately suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is VIs. The woodland ordination symbol is 7S (jack pine). The primary forest habitat type is PAm, and the secondary type is QGCe.

MnD—Menahga loamy sand, 12 to 25 percent slopes

This very deep, moderately steep and steep, excessively drained soil is on side slopes on outwash plains. Individual areas are irregularly shaped and generally range from 10 to 60 acres in size.

Typically, the surface layer is black loamy sand about 3 inches thick. The subsoil is about 35 inches thick. It is dark brown and very friable. It is loamy sand in the upper part and sand in the lower part. The substratum to a depth of 60 inches or more is dark yellowish brown sand. In some areas the slope is less than 12 percent or more than 25 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek soils. These soils formed in loamy alluvium and in the underlying sandy outwash. They are in positions on the landscape similar to those of the Menahga soil. They make up 10 to 15 percent of the unit.

Permeability is rapid in the Menahga soil. The available water capacity is low. The content of organic matter is low or moderately low in the surface layer. The rooting depth of most plants is limited by droughtiness.

Most areas are wooded. A few areas have been planted to pine trees. Because of water erosion, droughtiness, and soil blowing, this soil is generally not suited to cultivated crops. It is poorly suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing, but forage yields are generally low because of the low available water capacity. Overgrazing can cause surface compaction, depletion of the plant cover, and an

increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, the equipment limitation, and seedling mortality are management concerns. Planting on the contour and carefully locating skid roads during harvest help to control water erosion. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock.

Because of the slope and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. The soil readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid permeability. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, this soil is poorly suited to dwellings. This limitation can be overcome by cutting and filling or by installing retaining walls. Also, the dwellings can be designed so that one side of the basement fronts on the lower part of the slope, or they can be constructed in areas of included soils where the slope is less than 12 percent.

Because of the slope, this soil is poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is VIs. The woodland ordination symbol is 7R (jack pine). The primary forest habitat type is PAm, and the secondary type is QGCe.

Mo—Moppet fine sandy loam, 0 to 2 percent slopes

This very deep, nearly level, moderately well drained soil is in plane or slightly convex areas on flood plains. It is subject to occasional flooding for very brief periods. Individual areas are long and narrow and generally range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is about 6 inches thick. It is brown, friable fine sandy loam that has thin strata of very fine sandy loam and silt loam. The upper part of the subsoil is about 19 inches thick. It is dark yellowish brown, friable fine sandy loam that has thin strata of fine sand. It is mottled in the lower part. The lower part of the subsoil is about 10 inches thick. It is dark yellowish brown, mottled, friable fine sandy loam that has thin strata of fine sand. The substratum to a depth of 60 inches or more is dark yellowish brown, mottled gravelly sand. In places the surface layer is silt loam. In some areas the substratum contains thin layers of silt loam or loam.

Included with this soil in mapping are small areas of the poorly drained and very poorly drained Fordum and Rib soils. Fordum soils formed in silty and loamy alluvium over sandy alluvium. They are in the slightly lower positions on the landscape. Rib soils formed in silty alluvium over sandy outwash. They are in positions on the landscape similar to those of the Moppet soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Moppet soil and rapid in the substratum. The available water capacity is moderate. The content of organic matter in the surface layer also is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The depth to an apparent seasonal high water table ranges from 2.5 to 3.5 feet.

Most areas are used as unimproved pasture or as woodland. If protected from flooding, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Dikes and diversions help to prevent flooding. Land smoothing, diversions, and interceptor subsurface drains help to remove excess water. If drainage tile is installed, silt and fine sand enter the tile lines unless a suitable filter is used to cover the tile. If cultivated crops are grown, soil blowing is a hazard. It can be controlled by conservation tillage, field windbreaks, and winter cover crops. Returning crop residue to the soil or adding other organic material reduces the amount of water lost through evaporation, helps to maintain fertility, increases the rate of water infiltration, and reduces the susceptibility to soil blowing.

A cover of pasture plants is effective in controlling soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet

periods. Log landings and haul roads can be stabilized with gravel. Planting and harvesting operations are limited during periods of flooding. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the flooding. Overcoming this hazard is difficult. A better suited site should be considered.

The land capability classification is IIIw. The woodland ordination symbol is 3L (red maple). The primary forest habitat type is AVDe, and the secondary type is AVDe.

NeB—Newood sandy loam, 2 to 6 percent slopes

This gently sloping, moderately well drained soil is on ridgetops on moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 5 to 150 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 2 inches thick. It is covered by 1 inch of black muck. The upper part of the subsoil is dark brown, friable loamy sand and sandy loam about 18 inches thick. The next part is brown, dark brown, and reddish brown, mottled, friable sandy loam about 19 inches thick. The lower part is yellowish red, mottled, friable loamy sand about 24 inches thick. The substratum to a depth of 80 inches or more is yellowish red, firm sandy loam. In places cobblestones are on the surface. In a few areas the surface layer is loam or silt loam. In some places the slope is more than 6 percent.

Included with this soil in mapping are small areas of the poorly drained Capitola and somewhat poorly drained Magnor soils. Capitola soils are in depressions and drainageways. Magnor soils are in concave areas and in drainageways. Also included are some areas that are very stony. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the subsoil in the Newood soil. It is slow in the lower part of the subsoil and very slow in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The depth to a perched seasonal high water table ranges from 2.5 to 3.5 feet.

Most areas are wooded. A few areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. Also, the soil is subject to soil blowing. Most areas have slopes that are too short and irregular for stripcropping, terraces, or contour farming. Conservation tillage and winter cover crops help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the restricted permeability in the lower part of the subsoil and in the substratum, this soil is poorly suited to septic tank absorption fields. Mounding the site with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

This soil is suited to dwellings without basements. Because of the wetness, however, it is only moderately suited to dwellings with basements. This limitation can be overcome by installing tile drains around the foundations and providing gravity outlets or other dependable outlets and by constructing foundations on coarse textured fill material, such as sand or gravel, above the level of wetness.

Because of the potential for frost action, this soil is only moderately suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is AAt.

NeC—Newood sandy loam, 6 to 15 percent slopes

This sloping, moderately well drained soil is on ridgetops and side slopes on moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 10 to 200 acres in size.

Typically, the surface layer is very dark gray sandy loam about 4 inches thick. The subsurface layer is brown gravelly sandy loam about 1 inch thick. The upper part of the subsoil is dark brown, very friable gravelly sandy loam about 8 inches thick. Below this is brown, very friable gravelly sandy loam about 4 inches thick. The next part of the subsoil is brown and reddish brown, friable and very friable gravelly sandy loam about 20 inches thick. The lower part of the subsoil is about 21 inches thick. It is reddish brown, mottled, firm gravelly sandy loam and sandy loam. The substratum to a depth of 60 inches or more is reddish brown, firm sandy loam. In places the surface layer is loam or silt loam. In some areas cobblestones are on the surface. In other areas the slope is less than 6 percent or more than 15 percent.

Included with this soil in mapping are small areas of the very poorly drained Capitola, well drained Newot, and somewhat poorly drained Magnor soils. Capitola soils are in depressions. Newot soils are in the higher positions on the landscape. Magnor soils are in concave areas and in drainageways. Also included are areas that are very stony. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the subsoil in the Newood soil. It is slow in the lower part of the subsoil and very slow in the substratum. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The depth to a perched seasonal high water ranges from 2.5 to 3.5 feet.

Most areas are wooded. A few areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. Also, the soil is subject to soil blowing. Most areas have slopes that are too short and irregular for stripcropping or contour farming. Conservation tillage and winter cover crops help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control water erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the restricted permeability in the lower part of the subsoil and in the substratum, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

Because of the slope, this soil is only moderately suited to dwellings without basements. Because of the wetness and the slope, it is only moderately suited to dwellings with basements. The wetness can be overcome by installing tile drains around foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on coarse textured fill material, such as sand or gravel, above the level of wetness. The slope can be overcome by cutting and filling, installing retaining walls, or designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope and the potential for frost action, this soil is only moderately suited to local roads and streets. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is AAt.

NoD—Newot sandy loam, 15 to 35 percent slopes

This moderately steep to very steep, well drained soil is on ridgetops and side slopes on moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and range from about 5 to 800 acres in size.

Typically, the surface layer is brown sandy loam about 2 inches thick. It is covered by 2 inches of black mucky peat. The upper part of the subsoil is dark brown, friable sandy loam about 17 inches thick. The lower part of the subsoil is dark reddish brown, friable sandy loam and reddish brown, very friable loamy sand about 41 inches thick. The substratum to a depth of 80 inches or more is dark reddish brown, firm, very compact sandy loam. In some areas the surface layer is fine sandy loam, loam, or silt loam.

Included with this soil in mapping are small areas of the moderately well drained Newood soils on the less sloping parts of the landscape. Also included are small areas that have slopes of less than 15 percent and areas that are very stony. Included areas make up less than 15 percent of the map unit.

Permeability is moderate in the upper part of the subsoil in the Newot soil. It is slow in the lower part of the subsoil and very slow in the substratum. The available water capacity is moderate. The content of organic matter in the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are wooded. The less sloping areas of this soil are suited to corn and small grain and to grasses and legumes for hay and pasture. The more sloping areas are generally unsuited to cultivated crops because of the slope and a severe hazard of water erosion. Also, the soil is subject to soil blowing. Most areas have slopes that are too short or irregular for stripcropping or contour farming. Using a system of conservation tillage and planting winter cover crops help to control water erosion and soil blowing. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and helps to control erosion and soil blowing.

A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, seedling mortality, the equipment limitation, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the slope and the restricted permeability in the lower part of the subsoil and in the substratum, this soil is poorly suited to septic tank absorption fields. The slope can be overcome by cutting and filling or by installing a trench absorption system on the contour. Also, the absorption field can be installed in areas of included soils where the slope is less than 12 percent.

Because of the slope, this soil is poorly suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 12 percent.

Because of the slope, this soil is poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is VIe. The woodland ordination symbol is 4R (northern red oak). The primary forest habitat type is AAt.

Ns—Newson loamy sand, 0 to 2 percent slopes

This very deep, nearly level, poorly drained soil is in drainageways and depressions on outwash plains. It is subject to ponding and is occasionally flooded for brief periods. Individual areas are irregularly shaped or elongated and generally range from 5 to 100 acres in size.

Typically, the surface layer is very dark brown loamy sand about 8 inches thick. The subsoil is about 20

inches thick. It is dark grayish brown, grayish brown, and light brownish gray, mottled, very friable sand. The substratum to a depth of 60 inches or more is light brownish gray, mottled sand. In places the surface layer is mucky loamy sand or muck.

Included with this soil in mapping are small areas of the somewhat poorly drained Meehan soils. These soils are in the slightly higher positions on the landscape. They make up 5 to 15 percent of the unit.

Permeability is rapid in the Newson soil. The available water capacity is low. The content of organic matter is high or very high in the surface layer. The rooting depth of most plants is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas of this soil are wooded or support wetland vegetation. Some areas are used as pasture. Undrained areas generally are not suited to cultivated crops because of the wetness. Where drained and protected from flooding, this soil is suited to corn and small grain, to grasses and legumes for hay and pasture, and to certain vegetables. Unless the soil is irrigated, crop yields typically are limited by the low available water capacity. The number of frost-free days per growing season is limited. Planting early maturing crop varieties or growing corn for silage helps to overcome the frost hazard. If drained and cultivated, the soil is subject to soil blowing.

This soil is poorly suited to pasture unless it is drained. Establishing an improved pasture is difficult because of the wetness. Grazing is limited to short periods when the soil is dry. The native vegetation is generally of poor quality for forage, for the commonly grown farm crops, and for certain vegetables.

This soil is suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Because of the wetness, planting on prepared ridges generally is needed if natural regeneration is unreliable. Selecting vigorous nursery stock for planting reduces the seedling mortality rate. Wetness commonly limits access by machinery to the dry summer months or to periods when the soil is frozen or snow cover is thick. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the flooding and the ponding. Overcoming these limitations is difficult. A better suited site should be considered.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 6W (jack pine). A forest habitat type has not been assigned.

Oe—Oesterle sandy loam, 0 to 2 percent slopes

This very deep, nearly level, somewhat poorly drained soil is in drainageways on outwash plains and stream terraces. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is brown, mottled sandy loam about 3 inches thick. The next layer is brown and dark brown, mottled sandy loam about 6 inches thick. The subsoil is about 14 inches thick. It is mottled. It is dark brown, friable sandy loam in the upper part and dark brown, very friable loamy sand in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, stratified sand and gravelly sand.

Included with this soil in mapping are small areas of the moderately well drained Scoba soils. These soils are in the slightly higher positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Oesterle soil and rapid or very rapid in the sandy outwash. The available water capacity is low. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by an apparent seasonal high water table, which is at a depth of 1.0 to 2.5 feet in undrained areas.

Most areas are used as cropland. A few areas are used as pasture or support woodland vegetation. If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Excess water can be removed by diversions, grassed waterways, surface drains, and interceptor subsurface drains. If tile drains are installed, the finer sand enters the tile lines unless a suitable filter covers the tile. If the soil is drained and cultivated, soil blowing is a hazard. Wind stripcropping, field windbreaks, and conservation tillage help to control soil blowing. Returning crop residue to the soil or adding other organic material reduces the hazard of soil blowing and the amount of water lost through evaporation, increases the rate of water infiltration, and helps to maintain fertility.

A cover of pasture plants is effective in controlling soil blowing. Alfalfa is short lived unless the soil is drained. Red clover is generally grown. Overgrazing or grazing when the soil is too wet causes surface

compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water. The wetness also is a limitation. On some sites, mounding with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

Because of the wetness, this soil is poorly suited to dwellings. This limitation can be overcome by installing tile drains around the foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on coarse textured fill material, such as sand or gravel, above the level of wetness.

Because of the potential for frost action, this soil is poorly suited to local roads and streets. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIw. The woodland ordination symbol is 3W (red maple). The primary forest habitat type is AVDe, and the secondary type is AAt.

OsC2—Otterholt silt loam, 6 to 12 percent slopes, eroded

This very deep, sloping, well drained soil is on side slopes on ground moraines. Individual areas are irregularly shaped and generally range from 5 to 50 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 9 inches thick. The next layer is brown and dark brown silt loam about 17 inches thick. The subsoil is about 19 inches thick. It is friable. It is dark brown silt loam in the upper part and dark reddish brown loam in the lower part. The substratum to a depth of 60 inches or more is reddish brown sandy loam. In places cobbles are on the surface. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the moderately well drained Spencer soils. These soils are in the slightly lower positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Otterholt soil and moderate or moderately slow in the till. The available water capacity is high. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the moderately slow permeability in the

substratum, this soil is poorly suited to septic tank absorption fields. Increasing the size of the absorption field can help to overcome this limitation in some areas.

Because of the shrink-swell potential and the slope, this soil is only moderately suited to dwellings. The shrink-swell potential can be overcome by excavating the soil and replacing it with coarse textured material, such as sand or gravel; by strengthening the basement walls; and by installing a subsurface drainage system at or below the basement elevation. The slope can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement or the base material. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material.

The land capability classification is IIIe. The woodland ordination symbol is 5L (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

OsD—Otterholt silt loam, 12 to 20 percent slopes

This very deep, moderately steep, well drained soil is on side slopes on ground moraines. Individual areas are irregularly shaped and generally range from 5 to 60 acres in size.

Typically, the surface layer is very dark brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is pale brown and dark yellowish brown silt loam about 10 inches thick. The subsoil is dark brown, friable silt loam about 19 inches thick. The upper 6 inches of the substratum is dark yellowish brown silt loam. The lower part to a depth of 60 inches or more is strong brown sandy loam. In places cobbles are on the surface. In some areas the slope is less than 12 percent or more than 20 percent.

Included with this soil in mapping are small areas of the moderately well drained Spencer soils. These soils are in the slightly lower positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the subsoil of the Otterholt soil and moderate or moderately slow in the substratum. The available water capacity is high. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet.

Most areas are used as woodland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, the equipment limitation, seedling mortality, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the slope and the moderately slow permeability in the substratum, this soil is poorly suited to septic tank absorption fields. Increasing the size of the absorption field can help to overcome the restricted permeability in some areas. The slope can be overcome by cutting and filling and by installing a trench absorption system on the contour. Also, the absorption field can be installed in areas of included soils where the slope is less than 12 percent.

Because of the slope, this soil is poorly suited to dwellings. This limitation can be overcome by cutting

and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 12 percent.

Because of low strength, the slope, and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement or the base material. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material.

The land capability classification is IVe. The woodland ordination symbol is 5R (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

Pc—Pits, gravel

This map unit consists of open excavations from which sand and gravel and, in a few places, glacial till have been removed to a depth of at least several feet. Individual areas are irregularly shaped and generally range from 3 to 30 acres in size.

Typically, the material on the bottom and sides of the pits is sand, stratified sand and gravel, or, less commonly, sandy or loamy glacial till. Many of the pits are still actively used as a source of sand and gravel. Some pits have been abandoned and are partially covered with brush and weeds.

Included in mapping are small areas of spoil material that was removed from the pit area before the excavation was made. Also included are areas of stones and boulders that are too large to be crushed. Some abandoned pits contain small areas of water. Included areas make up 10 to 15 percent of the unit.

The main management concern is reclamation of the pits after excavation. In most of the pits, land shaping and additions of suitable topsoil are needed before a plant cover can be established. The suitability of these pits for septic tank absorption fields, dwellings, and local roads and streets should be determined by onsite investigation.

No land capability classification, woodland ordination symbol, or forest habitat type is assigned.

PdB—Plainbo loamy sand, 2 to 6 percent slopes

This moderately deep, gently sloping, excessively drained soil is on outwash plains and stream terraces and on footslopes in the adjacent uplands. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsoil is dark brown and strong brown, very friable and loose sand about 18 inches thick. Below this to a depth of 60 inches or more is sandstone. In places the surface layer is sand.

Included with this soil in mapping are small areas of the excessively drained Menahga soils. These soils are sandy throughout. They are in positions on the landscape similar to those of the Plainbo soil. They make up 5 to 15 percent of the unit.

Permeability is rapid in the subsoil of the Plainbo soil and moderately slow or moderate in the sandstone. The available water capacity is very low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness and by the underlying sandstone.

Most areas are used as cropland. A few areas have been planted to pine trees. This soil is poorly suited to corn and small grain and to grasses and legumes for hay and pasture. In most years crop yields are limited by the very low available water capacity. If cultivated crops are grown, water erosion is a slight hazard. Also, the soil is subject to soil blowing. Winter cover crops, conservation tillage, wind stripcropping, and field windbreaks help to prevent excessive soil loss. Returning crop residue to the soil or adding other organic material helps to control water erosion and soil blowing, reduces the amount of water lost through evaporation, increases the rate of water infiltration, and helps to maintain fertility.

A cover of pasture plants is effective in controlling soil blowing and water erosion. Forage yields are generally low unless fertilizer is applied and the supply of moisture is adequate. Planting early in spring, before the soil has a chance to dry out, helps to overcome the droughtiness. Planting later in the year is likely to result in a poor survival rate. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation,

measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The windthrow hazard is a management concern. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees.

Because of the thin layer of soil over sandstone and the rapid permeability in the subsoil and substratum, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water.

This soil is suited to dwellings and to local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 5D (jack pine). The primary forest habitat type is AVDe, and the secondary type is PAm.

PdC—Plainbo loamy sand, 6 to 12 percent slopes

This moderately deep, sloping, excessively drained soil is on outwash plains and stream terraces and on footslopes and side slopes in the adjacent uplands. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is dark brown and yellowish brown, very friable sand in the upper 12 inches and brownish yellow, loose sand in the lower 14 inches. Below this to a depth of 60 inches or more is sandstone. In places the surface layer is sand. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the excessively drained Menahga soils. These soils are sandy throughout. They are in the lower positions on the landscape. They make up 5 to 15 percent of the unit.

Permeability is rapid in the subsoil of the Plainbo soil and moderately slow or moderate in the sandstone. The available water capacity is very low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness and by the underlying sandstone.

Most areas are used as pasture or woodland. This soil is not suited to cultivated crops because of droughtiness, water erosion, and soil blowing. A cover of pasture plants is effective in controlling water erosion and soil blowing. Forage yields are generally low because of the very low available water capacity. Planting early in spring, before the soil has a chance to dry out, helps to overcome the droughtiness. Planting later in the year is likely to result in a poor survival rate. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and the windthrow hazard are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees.

Because of the thin layer of soil over sandstone and the rapid permeability in the subsoil and substratum, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope, this soil is only moderately suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is VIs. The woodland ordination symbol is 5D (jack pine). The primary forest habitat type is AVDe, and the secondary type is PAm.

PdD—Plainbo loamy sand, 12 to 20 percent slopes

This moderately deep, moderately steep, excessively drained soil is on outwash plains and stream terraces and on side slopes in the adjacent

uplands. Individual areas are irregularly shaped or elongated and generally range from 5 to 160 acres in size.

Typically, the surface layer is very dark brown loamy sand about 3 inches thick. The subsoil is dark brown, strong brown, and dark yellowish brown, very friable sand about 21 inches thick. The substratum is yellowish brown and light olive brown sand about 6 inches thick. Below this to a depth of 60 inches or more is sandstone. In places the surface layer is sand.

Included with this soil in mapping are small areas of the well drained Hayriver soils. These soils formed in loamy residuum over glauconitic sandstone or over sandy residuum and glauconitic sandstone. They are in positions on the landscape similar to those of the Plainbo soil. They make up 5 to 15 percent of the unit.

Permeability is rapid in the subsoil of the Plainbo soil and moderately slow or moderate in the sandstone. The available water capacity is very low. The content of organic matter is moderately low or moderate in the surface layer. The rooting depth of most plants is limited by droughtiness and by the underlying sandstone.

Most areas are used as pasture or woodland. Some have been planted to pine trees. Because of droughtiness, water erosion, and soil blowing, this soil is not suited to cultivated crops. It is poorly suited to pasture. Forage yields are generally low because of the very low available water capacity. A cover of pasture plants is effective in controlling water erosion and soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, the equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. The sandy surface can interfere with the traction of wheeled equipment, especially during dry periods. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees.

Because of the thin layer of soil over sandstone, the rapid permeability in the subsoil and substratum, and the slope, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water.

Because of the slope, this soil is poorly suited to dwellings. This limitation can be overcome by cutting and filling or by installing retaining walls. Also, the dwellings can be designed so that one side of the basement fronts on the lower part of the slope.

Because of the slope, this soil is poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is VIIs. The woodland ordination symbol is 5R (jack pine). The primary forest habitat type is AVDe, and the secondary type is PAm.

Px—Poskin silt loam, 0 to 2 percent slopes

This very deep, nearly level, somewhat poorly drained soil is in shallow depressions and drainageways on outwash plains. Individual areas are irregularly shaped and generally range from 5 to 40 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 3 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 7 inches thick. The subsoil is about 20 inches thick. It is mottled and friable. It is yellowish brown and dark brown silt loam in the upper part and dark brown sandy loam in the lower part. The substratum to a depth of 60 inches or more is reddish brown, stratified gravelly sand and sand.

Included with this soil in mapping are small areas of the moderately well drained Brill and poorly drained Rib soils. Brill soils are in the slightly higher positions on the landscape. Rib soils are in the lower positions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Poskin soil, moderate or moderately rapid in the loamy lower part of the subsoil, and rapid or very rapid in the sandy outwash. The available water capacity is moderate. The content of organic matter in the surface layer also is moderate. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The

rooting depth of most crops is limited by an apparent seasonal high water table, which is at a depth of 1.0 to 2.5 feet in undrained areas.

Most areas are used as cropland. A few areas are used as pasture. If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Excess water can be removed by diversions, grassed waterways, surface drains, and interceptor subsurface drains. If tile drains are installed, silt and the finer sand enter the tile lines unless a suitable filter covers the tile. Applying a system of conservation tillage and returning crop residue to the soil or adding other organic material can reduce the amount of water lost through evaporation, increase the rate of water infiltration, and help to maintain fertility.

This soil is suited to pasture. The surface layer is subject to crusting, which restricts the emergence of the plants. Alfalfa is generally short lived because of the seasonal high water table and the winterkill caused by frost heave. Red clover is generally grown. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or the snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water. The wetness also is a limitation. On some sites, mounding with suitable filtering material helps to overcome these limitations. Also, in some areas the effluent can be pumped to an absorption field established on better suited soils on the higher parts of the landscape.

Because of the wetness, this soil is poorly suited to dwellings. This limitation can be overcome by installing tile drains around the foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on coarse textured fill material, such as sand or gravel, above the level of wetness.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement or the base material. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIw. The woodland ordination symbol is 3W (red maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

QuA—Quarderer silt loam, 0 to 3 percent slopes

This very deep, nearly level and gently sloping, moderately well drained soil is in drainageways on uplands. It is occasionally flooded for very brief or brief periods. Individual areas are elongated and generally range from 5 to 60 acres in size.

Typically, the surface layer is silt loam about 13 inches thick. It is very dark grayish brown in the upper part and dark brown in the lower part. The upper part of the substratum is stratified very dark grayish brown and dark yellowish brown silt loam about 9 inches thick. The buried surface layer is very dark brown and dark brown silt loam about 7 inches thick. The buried subsoil is dark yellowish brown silt loam about 26 inches thick. It is mottled in the lower part. The buried substratum to a depth of 72 inches or more is yellowish brown, mottled silt loam. In places the surface layer is loam. In some areas the slope is more than 3 percent.

Included with this soil in mapping are small areas that have a seasonal high water table at a depth of 1.0 to 3.5 feet. These areas make up 5 to 10 percent of the unit.

Permeability is moderate in the Quarderer soil. The available water capacity is very high. The content of organic matter is moderate or high in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The depth to an apparent seasonal high water table ranges from 3.5 to 6.0 feet.

Most areas are used as cropland. A few areas are used as pasture. This soil is suited to corn and small

grain and to grasses and legumes for hay and pasture. Dikes and diversions help to prevent flooding. Applying a system of conservation tillage and returning crop residue to the soil or adding other organic material can help to maintain fertility and good tilth, increase the rate of water infiltration, and reduce the hazard of scouring by floodwater.

This soil is suited to pasture. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the flooding, the wetness, and the potential for frost action. Overcoming these limitations is difficult. A better suited site should be considered.

The land capability classification is I. The woodland ordination symbol is 5L (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

Rb—Rib silt loam, 0 to 2 percent slopes

This very deep, nearly level, poorly drained soil is in depressions and drainageways on flood plains, outwash plains, and stream terraces. It is subject to ponding and is occasionally flooded for very brief or brief periods. Individual areas are oblong and generally range from 5 to 50 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsoil is about 28 inches thick. It is grayish brown and light brownish gray, mottled, friable silt loam in the upper part and light brownish gray, friable gravelly loam in the lower part. The substratum to a depth of 60 inches or more is dark brown, stratified very gravelly sand and gravelly sand. In places the substratum has loamy strata. In some areas the surface layer is mucky silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Poskin soils. These soils are in the slightly higher positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Rib soil. It is moderate or moderately rapid in the loamy lower part of the subsoil and rapid or very rapid in the sandy outwash. The available water capacity is moderate. The content of organic matter is moderate to very high in the surface layer. The surface layer is friable, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most plants is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas of this soil are used as unimproved pasture or as woodland. Undrained areas generally are not suited to cultivated crops because of the wetness, the flooding, and the frost hazard. Drained areas are suited to corn and small grain and to grasses and legumes for hay and pasture. If tile drains are installed, silt and the finer sand enter the tile lines unless a suitable filter covers the tile. The number of frost-free days per growing season is limited. Planting early maturing crop varieties or growing corn for silage helps to overcome the frost hazard.

This soil is poorly suited to pasture unless it is drained and protected from flooding. Establishing or maintaining improved pasture is difficult because of the wetness. Grazing is limited to short periods when the soil is dry. The native vegetation generally is of poor quality for forage.

This soil is suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Because of the wetness, hand planting or machine planting on prepared ridges generally is needed if natural regeneration is unreliable. Selecting vigorous nursery stock for planting reduces the seedling mortality rate. Planting and harvesting activities are limited during periods of flooding. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the flooding and the ponding. Overcoming these limitations is difficult. A better suited site should be considered.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 2W (red maple). A forest habitat type has not been assigned.

RhC—Ribhill cobbly silt loam, 2 to 15 percent slopes, very stony

This moderately deep, gently sloping to moderately steep, well drained soil is on ridgetops and side slopes on quartzite monadnocks. In most areas it has stones on the surface. Most areas of this unit are long and narrow or irregularly shaped and generally range from about 20 to 500 acres in size.

Typically, the surface layer is very dark brown cobbly silt loam about 3 inches thick. The subsurface layer is brown cobbly silt loam about 3 inches thick. The next layer is dark yellowish brown and yellowish brown very cobbly silt loam about 7 inches thick. The subsoil is about 25 inches thick. It is dark brown cobbly silt loam in the upper part and reddish brown and dark brown cobbly and very cobbly sandy loam in the lower part. Fractured quartzite bedrock is at a depth of about 38 inches. In some areas the slope is less than 2 percent or more than 15 percent.

Included with this soil in mapping are small areas of the well drained Santiago soils. These soils formed in loess or other silty deposits and in the underlying dense sandy loam or loam glacial till. They are in positions on the landscape similar to those of the Ribhill soil. Also included are small areas of Ribhill soils that have bedrock at a depth of less than 20 inches or more than 40 inches and areas of Rubble land. Included areas make up about 5 to 15 percent of the unit.

Permeability is moderate in the subsoil of the Ribhill soil and very slow to rapid in the quartzite bedrock. The available water capacity is low. The content of organic matter is high or very high in the surface layer. The rooting depth of most plants is limited by the depth to bedrock, which ranges from 20 to 40 inches.

Most areas are used as woodland. This soil is generally unsuited to cropland or pasture because of the slope and the many cobbles and stones.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. The use of equipment for tree planting and harvesting is limited by the many cobbles. The slope and the cobbles on the surface limit the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Hard bedrock limits the depth of cuts and interferes with the construction of haul roads and log landings. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or by mechanical removal.

Because of the large stones and the thin layer of soil above the quartzite bedrock, this unit is generally unsuited to septic tank absorption fields. Seepage of untreated effluent into fractures and cracks in the bedrock can result in the pollution of ground water. Because of the large stones and the depth to bedrock, the soil is generally unsuited to dwellings. Overcoming these limitations is difficult. A better suited site should be considered.

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.

The land capability classification is VIIs. The woodland ordination symbol is 4L (northern red oak). The primary forest habitat type is AAt, and the secondary type is ACaCi.

RhE—Ribhill cobbly silt loam, 15 to 40 percent slopes, very stony

This moderately deep, moderately steep to very steep, well drained soil is on side slopes on quartzite monadnocks. In most areas it has stones on the surface. Most areas of this unit are long and narrow or irregularly shaped and generally range from about 20 to 600 acres in size.

Typically, the surface layer is very dark grayish brown cobbly silt loam about 7 inches thick. The subsurface layer is brown cobbly silt loam about 3 inches thick. The next layer is dark yellowish brown and brown very cobbly silt loam about 5 inches thick. The subsoil is about 20 inches thick. It is dark yellowish brown very cobbly silt loam in the upper part and brown very cobbly loam in the lower part. Fractured quartzite bedrock is at a depth of about 30 inches. In some areas the slope is less than 15 percent or more than 40 percent.

Included with this soil in mapping are small areas of Ribhill soils that have bedrock at a depth of less than 20 inches or more than 40 inches. Also included are areas of Rubble land. Included areas make up about 5 to 15 percent of the unit.

Permeability is moderate in the subsoil of the Ribhill soil and very slow to rapid in the quartzite bedrock. The available water capacity is low. The content of organic matter is high or very high in the surface layer. The rooting depth of most plants is limited by the depth to bedrock, which ranges from 20 to 40 inches.

Most areas are used as woodland. This soil is generally unsuited to cropland or pasture because of the slope and the many cobbles, stones, and bedrock outcrops.

This soil is suited to trees. The hazard of water erosion, the equipment limitation, the windthrow hazard, seedling mortality, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. The use of equipment for tree planting and harvesting is limited by the many cobbles and bedrock outcrops. The slope and the cobbles on the surface limit the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Hard bedrock limits the depth of cuts and interferes with the construction of haul roads and log landings. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Seedling survival on the steeper south- or west-facing slopes can be improved by carefully planting vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or by mechanical removal.

Because of the slope, the large stones, and the thin layer of soil above the quartzite bedrock, this unit is generally unsuited to septic tank absorption fields. Seepage of untreated effluent into fractures and cracks in the bedrock can result in the pollution of ground water. Because of the depth to rock, the slope, and the large stones, the soil is generally unsuited to dwellings and to local roads and streets. Overcoming these limitations is difficult. A better suited site should be considered.

The land capability classification is VIIs. The woodland ordination symbol is 4R (northern red oak). The primary forest habitat type is AAt, and the secondary type is ACaCi.

RoA—Rosholt loam, 0 to 2 percent slopes

This very deep, nearly level, well drained soil is in plane areas on outwash plains and stream terraces. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The next layer is brown and dark brown loam about 4 inches thick. The subsoil is about 17 inches thick. It is dark brown, friable loam in the upper part; reddish brown, friable sandy loam in the next part; and yellowish red, very friable very gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is strong brown, stratified very gravelly sand and gravelly sand. In places the surface layer is sandy loam. In some areas the content of gravel and cobbles in the surface layer is as much as 5 percent.

Included with this soil in mapping are small areas of the moderately well drained Scoba soils. These soils are in the slightly lower positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Rosholt soil and rapid or very rapid in the sandy outwash. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the sandy part of the subsoil and in the substratum.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Applying a system of conservation tillage and returning crop residue to the soil or adding other organic material can help to maintain fertility and good tilth and increase the rate of water infiltration.

This soil is suited to pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is suited to dwellings. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity.

Because of the potential for frost action, this soil is only moderately suited to local roads and streets.

Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIs in nonirrigated areas and I in irrigated areas. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt or AVDe.

RoB—Rosholt loam, 2 to 6 percent slopes

This very deep, gently sloping, well drained soil is in plane or slightly convex areas on outwash plains and stream terraces. Individual areas are irregularly shaped and generally range from 5 to 100 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsurface layer is brown loam about 3 inches thick. The next layer is brown and dark brown loam about 9 inches thick. The subsoil is about 16 inches thick. It is dark brown, friable loam in the upper part; reddish brown, friable sandy loam in the next part; and dark brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of 60 inches or more is strong brown, stratified very gravelly sand and gravelly sand. In places the surface layer is sandy loam. In some areas the content of gravel and cobbles in the surface layer is as much as 5 percent. In other areas the slope is less than 2 percent or more than 6 percent.

Included with this soil in mapping are small areas of the moderately well drained Scoba soils. These soils are in the slightly lower positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Rosholt soil and rapid or very rapid in the sandy outwash. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the sandy part of the subsoil and in the substratum.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is suited to dwellings. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity.

Because of the potential for frost action, this soil is only moderately suited to local roads and streets. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt or AVDe.

RoC2—Rosholt loam, 6 to 12 percent slopes, eroded

This very deep, sloping, well drained soil is in convex areas and on side slopes on outwash plains and stream terraces. Individual areas are irregularly shaped and generally range from 5 to 50 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown loam about 8 inches thick. The next layer is brown and dark brown loam about 4 inches thick. The subsoil is about 16 inches thick. It is dark brown, friable loam in the upper part; dark brown, friable sandy loam in the next part; and dark brown, very friable loamy sand in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, stratified gravelly sand and sand. In places the surface layer is sandy loam. In some areas cobbles are on the surface. In other areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Chetek and Cress

soils. These soils are thinner to sandy outwash than the Rosholt soil. They are in positions on the landscape similar to those of the Rosholt soil. They make up 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the loamy mantle of the Rosholt soil and rapid or very rapid in the sandy outwash. The available water capacity is moderate. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the sandy part of the subsoil and in the substratum.

Most areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of the slope and the potential for frost action, this soil is only moderately suited to local roads and streets. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt or AVDe.

Ru—Rubble land

This map unit is on very steep side slopes on quartzite monadnocks. Individual areas are long and narrow and range from 5 to 50 acres in size.

Typically, the material in this map unit consists of angular quartzite cobbles, stones, and boulders. Most areas do not support vegetation.

Included in mapping are small areas in which a thin layer of moss or organic material is over the quartzite fragments. Also included are a few areas that support a very limited number of trees, which grow in loamy material between the quartzite fragments, and a few areas in which the quartzite is crushed for use as road material or decorative landscaping material. Included areas make up 5 to 15 percent of the unit.

This unit generally is not suitable as a site for septic tank absorption fields, dwellings, or local roads and streets because of the slope and the bedrock. Overcoming these limitations is difficult. A better suited site should be selected.

The land capability classification is VIIIs. No woodland ordination symbol or forest habitat type is assigned.

SaB—Santiago silt loam, 2 to 6 percent slopes

This gently sloping, well drained soil is in plane or slightly convex areas on ground moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 5 to 60 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 brown, dark brown, and dark yellowish brown silt loam about 18 inches thick. The subsoil is about 44 inches thick. It is friable. It is dark reddish brown loam in the upper part and reddish brown sandy loam in the lower part. The substratum to a depth of 80 inches or more is

reddish brown, firm sandy loam. In places cobbles are on the surface. In some areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of the moderately well drained Freeon soils. These soils are in depressions in the lower positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Santiago soil. It is slow or moderately slow in the loamy lower part of the subsoil and very slow in the substratum. The available water capacity is high. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is suited to dwellings. It is poorly suited to septic tank absorption fields because of the very slow permeability in the substratum. Mounding the site with suitable filtering material helps to overcome this limitation. Also, in some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

Because of the potential for frost action, this soil is only moderately suited to local roads and streets. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 4L (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

SaC2—Santiago silt loam, 6 to 12 percent slopes, eroded

This sloping, well drained soil is on side slopes on ground moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 5 to 80 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 10 inches thick. The next layer is brown and dark yellowish brown silt loam about 13 inches thick. The subsoil is dark brown and dark reddish brown, friable gravelly sandy loam and sandy loam about 64 inches thick. The substratum to a depth of 102 inches or more is reddish brown, firm sandy loam. In places cobbles are on the surface.

Included with this soil in mapping are small areas of the moderately well drained Freeon soils. These soils are in the lower positions on the landscape. They make up 5 to 15 percent of the unit.

Permeability is moderate in the silty mantle of the Santiago soil. It is moderately slow or slow in the loamy lower part of the subsoil and very slow in the substratum. The available water capacity is high. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet.

Most areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The

slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the very slow permeability in the substratum, this soil is poorly suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling or by installing retaining walls. Also, the dwellings can be designed so that one side of the basement fronts on the lower part of the slope.

Because of the slope and the potential for frost action, this soil is only moderately suited to local roads and streets. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4L (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

SaD2—Santiago silt loam, 12 to 20 percent slopes, eroded

This moderately steep, well drained soil is on side slopes on ground moraines. It is deep or very deep to dense till. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 9 inches thick. The next layer is brown and dark brown silt loam about 13 inches thick. The subsoil is about 27 inches thick. It is mostly reddish brown, friable sandy loam. The substratum to a depth of 60 inches or more is yellowish red, firm sandy loam. In places cobbles are on the surface. In some areas the slope is less than 12 percent or more than 20 percent.

Included with this soil in mapping are small areas of the well drained Amery soils. These soils have a loamy mantle. They are in positions on the landscape similar to those of the Santiago soil. They make up 5 to 15 percent of the unit.

Permeability is moderate in the silty mantle of the Santiago soil. It is moderately slow or slow in the loamy lower part of the subsoil and very slow in the substratum. The available water capacity is high. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet.

Most areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. It can be controlled by contour farming, contour stripcropping, crop rotations that include grasses and legumes, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, the equipment limitation, seedling mortality, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the slope and the very slow permeability in the substratum, this soil is poorly suited to septic tank absorption fields. The slope can be overcome by cutting and filling and by installing a trench absorption system on the contour. Also, the absorption field can be installed in areas of included soils where the slope is less than 12 percent.

Because of the slope, this soil is poorly suited to

dwellings. This limitation can be overcome by cutting and filling or by installing retaining walls. Also, the dwellings can be designed so that one side of the basement fronts on the lower part of the slope.

Because of the slope, this soil is poorly suited to local roads and streets. This limitation can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is IVe. The woodland ordination symbol is 4R (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

ScA—Scoba sandy loam, 0 to 3 percent slopes

This very deep, nearly level and gently sloping, moderately well drained soil is in plane and slightly concave areas on outwash plains. Individual areas are irregularly shaped and generally range from 5 to 50 acres in size.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The next layer is brown and dark yellowish brown sandy loam about 11 inches thick. The subsoil is about 11 inches thick. It is mottled. The upper part is dark brown, friable sandy loam, and the lower part is dark brown, friable loamy sand. The substratum to a depth of 60 inches or more is strong brown, stratified sand and gravelly sand. In places the surface layer is loam. In some areas cobbles are on the surface.

Included with this soil in mapping are small areas of the somewhat poorly drained Oesterle and well drained Rosholt soils. Oesterle soils are in the slightly lower positions on the landscape. Rosholt soils have loam in the surface layer and the upper part of the subsoil. They are in the slightly higher positions on the landscape. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the loamy mantle of the Scoba soil and rapid or very rapid in the sandy outwash. The available water capacity is low. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. The rooting depth of most crops is limited by droughtiness in the substratum. The seasonal high water table is not within a depth of 6 feet, but a seasonal zone of near saturation is at a depth ranging from 1.5 to 3.0 feet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. In most years crop yields are limited by the low available water capacity. If cultivated crops are grown, soil blowing is a hazard. It can be controlled by conservation tillage, field windbreaks, and winter cover crops. Returning crop residue to the soil or adding other organic material reduces the amount of water lost through evaporation, helps to maintain fertility, increases the rate of water infiltration, and reduces the susceptibility to soil blowing.

A cover of pasture plants is effective in controlling soil blowing. Overgrazing can cause surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is suited to dwellings. It readily absorbs the effluent in septic tank absorption fields. It does not adequately filter the effluent, however, because of the rapid or very rapid permeability in the substratum. The poor filtering capacity can result in the pollution of ground water. Mounding the site with suitable filtering material helps to overcome the poor filtering capacity. Also, the effluent can be pumped to an absorption field on a better suited soil in some nearby areas.

Because of the potential for frost action, this soil is only moderately suited to local roads and streets. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIs in nonirrigated areas and I in irrigated areas. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is AVDe, and the secondary type is AAt.

Sm—Seelyeville and Cathro mucks, 0 to 1 percent slopes

These very deep, nearly level, very poorly drained soils are in depressions and slightly concave areas on outwash plains and moraines. They are subject to ponding. Individual areas of this unit are irregularly shaped and generally range from 10 to 150 acres in size. A single mapped area may consist of either Seelyeville muck or Cathro muck, or it may consist of both soils. The two soils have similar behavioral

characteristics for present or anticipated uses in the survey area, and mapping them separately was not considered practical or necessary.

Typically, the Seelyeville soil is black and very dark brown muck to a depth of at least 60 inches. In places the surface layer is peat. In some areas strata of mucky peat or peat are below the surface layer.

Typically, the Cathro soil is very dark brown muck about 30 inches thick. The substratum to a depth of 60 inches or more is dark gray silt loam. In some places the surface layer is mucky peat or peat. In other places thin layers of mucky peat or peat are below the surface layer. In some areas the substratum is loam or sandy loam.

Included with these soils in mapping are small areas of the very poorly drained Beseman and Greenwood soils. These included soils formed in organic material that is very strongly acid or extremely acid throughout. They are in positions on the landscape similar to those of the Seelyeville and Cathro soils. They make up 5 to 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the Seelyeville soil and in the organic layers of the Cathro soil. It is moderate in the substratum of the Cathro soil. The available water capacity is very high in both soils. The content of organic matter also is very high. The rooting depth of most plants is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas support wetland vegetation. Because of the wetness, a scarcity of suitable drainage outlets, and the hazard of frost in late spring or early fall, these soils are generally not suited to cultivated crops or pasture. If drained and cultivated, they are subject to burning and subsidence. Also, they are subject to soil blowing.

Because of the high water table, these soils are poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Wetness and low soil strength generally limit access by machinery to periods when the soil is frozen or snow cover is thick. Reforestation is generally limited to natural regeneration. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

These soils are generally unsuited to use as sites for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the ponding. Overcoming this limitation is difficult. A better suited site should be considered.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 3W (black spruce) for the Seelyeville soil and 7W (balsam fir) for the Cathro soil. A forest habitat type has not been assigned.

SoA—Siouxcreek silt loam, 0 to 3 percent slopes

This moderately deep, nearly level and gently sloping, somewhat poorly drained soil is in drainageways and depressions on uplands. Individual areas are irregularly shaped and generally range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 2 inches thick. The next layer is brown and dark yellowish brown, mottled silt loam about 12 inches thick. The upper part of the subsoil is about 10 inches thick. It is dark yellowish brown, mottled, and friable. It is fine sandy loam in the upper part and sandy loam in the lower part. The lower part of the subsoil is light yellowish brown, mottled, loose fine sand about 6 inches thick. Below this to a depth of 60 inches or more is fine grained sandstone. In some places the surface layer is sandy loam or loam.

Included with this soil in mapping are small areas of the well drained Arland and Hayriver soils. These soils are in the slightly higher positions on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the loamy mantle of the Siouxcreek soil. It is moderately rapid or rapid in the sandy residuum and moderately slow or moderate in the sandstone. The available water capacity is low. The content of organic matter is moderately low or moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The rooting depth of most crops is limited by a perched seasonal high water table, which is at a depth of 1.0 to 2.5 feet in undrained areas.

Most areas are used as pasture or cropland. If drained, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Excess water can be removed by diversions, grassed waterways, surface drains, and interceptor subsurface drains. If tile drains are installed, the finer sand enters the tile lines unless a suitable filter covers the tile. Applying a system of conservation tillage and adding other organic material reduce the amount of water lost through evaporation, increase the rate of water infiltration, and help to maintain fertility.

This soil is suited to pasture. The surface layer is subject to crusting, which restricts the emergence of

the plants. Alfalfa is short lived unless the soil is drained. Red clover is generally grown. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation, the windthrow hazard, and plant competition are management concerns. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the thin layer of soil over sandstone, the moderately rapid or rapid permeability in the substratum, and the wetness, this unit is poorly suited to septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in seepage of untreated effluent into crevices and bedding planes in the underlying sandstone and possibly into the ground water. On some sites, mounding with suitable filtering material helps to overcome these limitations.

Because of the wetness, this soil is poorly suited to dwellings. This limitation can be overcome by constructing foundations on coarse textured fill material, such as sand or gravel, above the level of wetness and by installing tile drains around the foundations and providing gravity outlets or other dependable outlets.

Because of the wetness and the potential for frost action, this soil is only moderately suited to local roads and streets. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by wetness. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIw. The woodland ordination symbol is 3W (red maple). The primary forest habitat type is AAt, and the secondary type is ACaCi.

SrB—Spencer silt loam, 2 to 6 percent slopes

This very deep, gently sloping, moderately well drained soil is on side slopes and knolls on ground moraines. Individual areas are irregularly shaped and generally range from 5 to 125 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next layer is brown and dark yellowish brown silt loam about 18 inches thick. The subsoil is about 18 inches thick. It is friable and mottled. It is dark yellowish brown silt loam in the upper part and dark brown loam in the lower part. The substratum to a depth of 72 inches or more is reddish brown sandy loam. In some areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Almena and well drained Otterholt soils. Almena soils are in the lower positions on the landscape. Otterholt soils are in the slightly higher positions. Included soils make up 2 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Spencer soil and moderately slow or moderate in the till. The available water capacity is high. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The depth to a perched seasonal high water table ranges from 2.5 to 3.5 feet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a slight or moderate hazard. It can be controlled by terraces, contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns.

Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the moderately slow permeability in the substratum, this soil is poorly suited to septic tank absorption fields. Mounding the site with suitable filtering material helps to overcome these limitations. Also, the effluent can be pumped to an absorption field on a better suited soil in some nearby areas.

Because of the shrink-swell potential, this soil is only moderately suited to dwellings. This limitation can be overcome by excavating the soil and replacing it with coarse textured material, such as sand or gravel; by strengthening the basement walls; and by installing a subsurface drainage system at or below the basement elevation. The wetness is an additional limitation on sites for dwellings with basements. It can be overcome by installing tile drains around the foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on coarse textured fill material above the level of wetness.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement or the base material. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

SrC2—Spencer silt loam, 6 to 12 percent slopes, eroded

This very deep, sloping, moderately well drained soil is on side slopes and knolls on ground moraines. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 10 inches thick. The next layer is brown and dark yellowish brown silt loam about 8 inches thick. The subsoil is about 16 inches thick. The upper part is dark yellowish brown silt loam, the next part is mottled dark yellowish brown silt loam, and the lower part is mottled strong brown silt loam. The upper 8 inches of the substratum is dark yellowish brown, mottled silt loam. The lower part to a depth of 60 inches or more is yellowish red sandy loam. In places cobbles are on the surface. In some areas the slope is less than 6 percent.

Included with this soil in mapping are small areas of the well drained Otterholt and Santiago soils. Otterholt soils are in the slightly higher positions on the landscape. Santiago soils have a silty mantle that is thinner than that of the Spencer soil. They are in the higher positions on the landscape. Included soils make up 2 to 10 percent of the unit.

Permeability is moderate in the silty mantle of the Spencer soil and moderately slow or moderate in the till. The available water capacity is high. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet. The depth to a perched seasonal high water table ranges from 2.5 to 3.5 feet.

Most areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by terraces, contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the wetness and the moderately slow permeability in the substratum, this soil is poorly

suited to septic tank absorption fields. In some areas the effluent can be pumped to an absorption field on a better suited nearby soil.

Because of the slope and the shrink-swell potential, this soil is only moderately suited to dwellings. The slope can be overcome by cutting and filling or by installing retaining walls. Also, the dwellings can be designed so that one side of the basement fronts on the lower part of the slope. The shrink-swell potential can be overcome by excavating the soil and replacing it with coarse textured material, such as sand or gravel; by strengthening the basement walls; and by installing a subsurface drainage system at or below the basement elevation. The wetness is an additional limitation on sites for dwellings with basements. It can be overcome by installing tile drains around foundations and providing gravity outlets or other dependable outlets and by constructing the foundations on coarse textured fill material above the level of wetness.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel, and by increasing the thickness of the pavement or the base material. The road damage caused by frost action can be minimized by replacing the upper part of the soil with coarse textured base material and by providing adequate roadside ditches, which help to drain the roadbed and maintain the natural drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 3L (sugar maple). The primary forest habitat type is ACaCi, and the secondary type is AAt.

Ud—Udorthents, nearly level

These soils are primarily in or near cities and villages where the landscape has been altered by excavation, filling, or leveling. Individual areas are irregularly shaped and range from about 3 to 30 acres in size.

Typically, these soils vary widely in color, texture, and thickness. They are dominantly sandy or loamy and are gravelly or very gravelly in some areas. They are commonly in areas of Chetek, Freeon, or Rosholt soils. Some areas have slopes of more than 2 percent.

Permeability, the available water capacity, and natural fertility also vary widely, depending on the texture of the remaining soil material.

Most areas are no longer used as a source of fill material and have naturally reverted to weeds, brush, and trees. Most areas of these soils have been smoothed or leveled, and a thin layer of topsoil has been returned. Some areas are used as cropland or pasture.

The suitability of these soils for crops or pasture or for septic tank absorption fields, dwellings, or local roads and streets can best be determined by onsite investigation.

No land capability classification, woodland ordination symbol, or forest habitat type is assigned.

Va—Vancecreek silt loam, 0 to 2 percent slopes

This very deep, nearly level, poorly drained soil is in plane or concave areas on flood plains and in drainageways. It is subject to ponding, which can last for long periods, and is frequently flooded for brief or very brief periods. Individual areas are long and narrow and generally range from 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 16 inches thick. It is mottled in the lower part. The subsoil is grayish brown and olive gray, mottled, friable silt loam about 33 inches thick. The substratum to a depth of 60 inches or more is dark greenish gray, mottled silt loam. In some places a thin organic layer is on the surface.

Included with this soil in mapping are small areas of Fordum soils. These soils formed in silty and loamy alluvium over sandy alluvium. They are in positions on the landscape similar to those of the Vancecreek soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Vancecreek soil. The available water capacity is very high. The content of organic matter is moderate to very high in the surface layer. The rooting depth of most plants is limited by an apparent seasonal high water table, which is near or above the surface in undrained areas.

Most areas are used as unimproved pasture. A few areas support wetland vegetation. Because of the wetness, a scarcity of suitable drainage outlets, the flooding, and the hazard of frost in late spring and early fall, this soil generally is not suited to cultivated crops. It is poorly suited to pasture unless it is drained and protected from flooding. Establishing or maintaining improved pasture is difficult because of the wetness. The native vegetation is generally of poor quality for forage. Grazing is limited to the short periods when the soil is dry.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Because of the wetness, hand planting or machine planting on prepared ridges generally is needed.

Selecting vigorous nursery stock for planting reduces the seedling mortality rate. Planting and harvesting activities are limited during periods of flooding. Seedling mortality may be high unless protection from flooding is provided. Wetness and low soil strength frequently limit access by machinery to the dry summer months or to periods when the soil is frozen or snow cover is thick. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

This soil is generally unsuited to use as a site for septic tank absorption fields, dwellings, or local roads and streets, mainly because of the flooding and the ponding. Overcoming these limitations is difficult. A better suited site should be considered.

The land capability classification is VIw in undrained areas. The woodland ordination symbol is 2W (silver maple). A forest habitat type has not been assigned.

WkC2—Wickware silt loam, 6 to 12 percent slopes, eroded

This very deep, sloping, well drained soil is on footslopes in the uplands. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 10 inches thick. The next layer is dark yellowish brown and pale brown silt loam about 7 inches thick. The subsoil is dark brown and strong brown, friable silt loam about 19 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown silt loam. In places the lower part of the substratum has strata of fine sand. In some areas the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of the well drained Dobie and moderately well drained Doritty soils. Dobie soils are underlain by sandstone. They are in the higher positions on the landscape. Doritty soils are in the slightly lower positions on the landscape. Included soils make up 2 to 10 percent of the unit.

Permeability is moderate in the Wickware soil. The available water capacity is very high. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a moderate hazard. It can be controlled by terraces, contour farming, contour stripcropping, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, pasture rotation, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The equipment limitation and plant competition are management concerns. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the moderate permeability and the slope, this soil is only moderately suited to septic tank absorption fields. In some areas the restricted permeability can be overcome by increasing the size of the absorption field. The slope can be overcome by cutting and filling or by installing a trench absorption system on the contour. Also, the absorption field can be installed in some areas of included soils where the slope is less than 6 percent.

Because of the slope, this soil is only moderately suited to dwellings. This limitation can be overcome by cutting and filling, by installing retaining walls, or by designing the dwellings so that one side of the basement fronts on the lower part of the slope. Also, the dwellings can be constructed in areas of included soils where the slope is less than 6 percent.

Because of low strength and the potential for frost action, this soil is poorly suited to local roads and streets. These limitations can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. Low strength also can be overcome by increasing the thickness of the pavement or the base material.

The land capability classification is IIIe. The woodland ordination symbol is 5L (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

WkD2—Wickware silt loam, 12 to 20 percent slopes, eroded

This very deep, moderately steep, well drained soil is on side slopes in the uplands. Individual areas are irregularly shaped and generally range from 5 to 30 acres in size.

In most cultivated areas on the crest of hills and the upper side slopes, water erosion has removed some of the original surface layer. Typically, the remaining surface layer is dark brown silt loam about 9 inches thick. The next layer is dark yellowish brown and brown silt loam about 6 inches thick. The subsoil is dark brown, friable silt loam about 23 inches thick. The substratum to a depth of 60 inches or more is yellowish brown silt loam. In places the lower part of the substratum has strata of fine sand. In some areas the slope is less than 12 percent or more than 20 percent.

Included with this soil in mapping are small areas of the well drained Dobie and moderately well drained Doritty soils. Dobie soils are underlain by sandstone. They are in the higher positions on the landscape. Doritty soils are in the lower positions on the landscape. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Wickware soil. The available water capacity is very high. The content of organic matter is moderate in the surface layer. The surface layer is friable and can be easily tilled, but it tends to crust and puddle after hard rains or if it is tilled when too wet.

Most areas are used as cropland or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. It can be controlled by contour farming, contour stripcropping, crop rotations that include grasses and legumes, and conservation tillage. Returning crop residue to the soil or adding other organic material helps to maintain fertility and good tilth, increases the rate of water infiltration, and reduces the hazard of water erosion.

A cover of pasture plants is effective in controlling water erosion. The surface layer is subject to crusting, which restricts the emergence of the plants. Overgrazing or grazing when the soil is too wet causes surface compaction, depletion of the plant cover, and an increase in the extent of undesirable plant species. Proper stocking rates, measures that improve fertility, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suited to trees. The hazard of water erosion, the equipment limitation, seedling mortality, and plant competition are management concerns. Planting on the contour and carefully locating skid roads during harvest minimize water erosion. The slope limits the selection of log landing sites. Landings can be established on suitable nearly level or gently sloping adjacent or included soils. Because the slope limits the use of conventional equipment, special harvesting and planting methods, such as yarding the logs by cable and planting seedlings by hand, may be needed. Ruts form easily on unsurfaced roads during wet periods. Log landings and haul roads can be stabilized with gravel. Seedling survival on the steeper south- or west-facing slopes can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by herbicides or by mechanical removal.

Because of the slope, this soil is poorly suited to septic tank absorption fields. This limitation can be overcome by cutting and filling or by installing a trench absorption system on the contour. Also, the absorption field can be installed in areas of included soils where the slope is less than 12 percent.

Because of the slope, this soil is poorly suited to dwellings. This limitation can be overcome by cutting and filling or by installing retaining walls. Also, the dwellings can be designed so that one side of the basement fronts on the lower part of the slope.

Because of low strength, the slope, and the potential for frost action, this soil is poorly suited to local roads and streets. Low strength and frost action can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. Low strength also can be overcome by increasing the thickness of the pavement or the base material. The slope can be overcome by shaping the roadway through cutting and filling. Constructing roads on the contour minimizes the amount of cutting required.

The land capability classification is IVe. The woodland ordination symbol is 5R (northern red oak). The primary forest habitat type is ACaCi, and the secondary type is AAt.

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 to prevent 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 behavioral 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 recreational 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. 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

John W. Pingry, agronomist, Natural Resources Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed, the system of land capability classification used by the Natural Resources Conservation Service is explained, and prime farmland is described.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service or from private soil science consultants.

In 1989, about 397,000 acres in Barron County was farmland. Of this total, about 200,500 acres was used as cropland, 35,000 acres for pasture, 152,900 acres as woodland, and 8,600 acres for other farm uses (Wisconsin Agricultural Statistics Service, 1989).

The potential for increased food production in Barron County is good. Some areas that are currently used as woodland could be cleared and used for crop production. Some areas that are now used for pasture could also be used for cultivated crops. Food production also could be increased considerably by applying the latest crop production technology and proper conservation practices to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology.

The major management concerns affecting crops and pasture in Barron County are water erosion, soil blowing, wetness, fertility, and tilth.

Water erosion is the major concern on about 65 percent of the cropland and pasture in the county. It is generally a hazard on soils that have slopes of more than 2 percent.

Loss of the surface layer through erosion is damaging in at least three ways. First, productivity is reduced as the surface layer is lost and part of the subsurface layer or subsoil is incorporated into the plow layer. The surface layer generally contains more organic matter than other parts of the soil. Second, incorporation of material from the subsurface layer or subsoil can result in poor tilth and crusting, which in turn can result in poor seed germination or seedling emergence. Third, erosion can result in the sedimentation of streams. Controlling erosion

minimizes this pollution and improves the quality of water for municipal or recreational uses and for fish and wildlife.

Erosion-control measures provide a protective ground cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the surface for extended periods can hold soil losses to an amount that does not reduce the productive capacity of the soils. On livestock farms, where pasture and hay are needed, including grasses and legumes in the cropping sequence not only provides nitrogen and improves tilth but also reduces the hazard of erosion.

Chisel plowing and other conservation tillage systems that leave crop residue on the surface increase the rate of water infiltration and reduce the hazard of erosion. These systems can be applied on most of the soils in the county.

Terraces and diversions reduce the length of slopes and thus reduce the hazard of erosion and the rate of runoff. These measures are most practical on very deep, well drained or moderately well drained, gently sloping or sloping soils. Otterholt, Spencer, and Wickware soils are suitable for terraces. Some soils are less well suited to terraces and diversions because they have irregular slopes, are moderately steep, or have sandstone within a depth of 40 inches.

Contour farming and contour stripcropping also help to control erosion. These practices are most effective in areas of soils that have uniform slopes, such as Arland, Dobie, and Spencer soils.

Soil blowing is a hazard on sandy and loamy soils, such as Chetek, Menahga, and Plainbo soils. It is also a hazard on organic soils, such as Seelyeville and Cathro soils, if they are drained and cultivated. Soil blowing can damage the soils and any young plants in just a few hours if winds are strong and the soils are dry and are not protected by vegetation or surface mulch. Maintaining a cover of plants or surface mulch, wind stripcropping, and establishing field windbreaks minimize the effects of soil blowing.

Information about the design of measures that control erosion and soil blowing on each soil in the county is provided in the Technical Guide, which is available in the local office of the Natural Resources Conservation Service.

Wetness is the major management concern on about 5 percent of the acreage used for crops or pasture in the county. Some soils are so wet that they generally cannot be used for the commonly grown crops unless they are drained. Examples of these soils are the very poorly drained Adolph soils and the poorly drained Auburndale, Adolph, Barronett, Capitola, Rib, and Vancecreek soils. Unless drained, Comstock, Magnor, Poskin, and other somewhat poorly drained soils also are so wet that crops are damaged during most years.

The design of both surface and subsurface drainage systems varies, depending on soil properties and site conditions. A combination of surface and subsurface drains is needed in most areas of the very poorly drained and poorly drained soils used for intensive row cropping. Diversions are needed in some areas to remove runoff from the adjacent fields. In Barronett and Comstock soils and other soils that are underlain by silt loam at the depth of drainage tile installation, special covering is needed over the tile. This covering helps to keep silt from filling and clogging the tile.

If organic soils are used as cropland, special management measures are necessary. These soils oxidize and subside when water is removed from pores and the pores are filled with air. Drainage systems that control the depth and period of drainage are needed. Keeping the water table at the level required for crop growth during the growing season and raising it to the surface during other parts of the year can minimize the oxidation and subsidence of these soils.

Further information about the design of drainage systems is provided in the Technical Guide, which is available in the local office of the Natural Resources Conservation Service.

Soil fertility varies in the soils of Barron County, depending on natural fertility and on cropping history. Most of the soils are naturally acid. Applications of lime are needed to raise the pH of these soils to the level required by the crop. Available phosphorus and potassium levels are naturally low or medium in most of the soils. On all soils, additions of lime or fertilizer should be based on the results of soil tests, the needs of the crop, and 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 of seeds, the emergence of seedlings, and the infiltration of water into the soils. Soils that have good tilth are granular and porous.

Tilling or grazing during wet periods can result in poor tilth, especially on soils that have a surface layer of silt loam, such as Anigon and Almena soils. If the surface of the soil is bare, a crust can form during periods of heavy rainfall. This crust reduces the rate of water infiltration and increases the runoff rate and the hazard of erosion. Maintaining tilth is especially difficult

on eroded soils because they have a lower content of organic matter than uneroded soils. Returning crop residue to the soil, growing green manure crops, and regularly adding manure improve tilth and minimize crusting.

Irrigation on some of the Anigon, Brill, Chetek, Friendship, Menahga, Oesterle, Poskin, Rosholt, and Scoba soils helps to maintain a sufficient amount of available water for specialty crops. Many of these soils are susceptible to leaching of nutrients, especially nitrogen. In 1993, about 12,500 acres in the county was irrigated, mostly by center-pivot systems. The water for irrigation is drawn from wells and ponds. The trend is toward greater use of wells.

Strong winds can prevent a uniform application of water from sprinkler systems. Field windbreaks and vegetative row barriers help to deflect the force of the wind and conserve available water.

Information about the design of irrigation systems for each kind of soil can be obtained from local offices of the Cooperative Extension Service and the Natural Resources Conservation Service.

Field crops suited to most of the soils and the climate of the county include corn, which is the most commonly grown row crop, and oats and barley, which are the most common close-growing crops. A limited acreage is used for wheat or soybeans.

The most commonly grown hay and pasture species are mixtures of alfalfa and bromegrass and mixtures of red clover and timothy. Bluegrass is the most common cool-season native pasture species.

Specialty crops grown commercially in the county include sweet corn, potatoes, snap beans, peas, kidney beans, rutabagas, and strawberries. Most of these crops are grown on the droughty soils on outwash plains, where the water supply for irrigation is plentiful.

The latest 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 tables 5 and 6. In any given year, yields may be higher or lower than those indicated in the tables because of variations in rainfall and other climatic factors. The land capability classification of map units in the survey area also is shown in the tables.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

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 tables 5 and 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. 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 or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA, 1961). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields tables.

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 land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forest land, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. 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.

More than 40 percent of the land area in Barron County, or about 220,000 acres, is prime farmland. This land is in areas throughout the county, mainly in associations 3, 5, and 7, which are described under the heading "General Soil Map Units." Approximately 150,000 acres of this prime farmland is used for crops. The crops grown on this land, mainly corn, oats, and alfalfa, account for an estimated two-thirds of the county's total agricultural income each year.

The map units in Barron County that are considered prime farmland are listed in table 7. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. 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."

Woodland Management and Productivity

Before the survey area was settled, the entire land area was forested, except for limited areas of marsh. The trees have been removed from about three-fourths of the original forest (Curtis, 1959). About 159,000 acres in Barron County is currently forested. The stands are dominated by northern hardwoods (maple-basswood or elm-ash) and aspen-birch forest types. Each of these forest types covers about 60,000 acres. The other forest types and their approximate acreages are conifers, 10,000 acres; swamp hardwoods (elm, black ash, white oak), 10,000 acres; and oak (red oak, white oak, northern pin oak), 19,000 acres (Smith, 1983).

About 87 percent of the forested acreage is privately owned. About 13 percent is county, state, or municipal forest.

The woodland is protected by a well organized system of fire control. The main management concern is the need for removal of defective trees and the less valuable species and the protection of the woodlots from grazing by livestock. Many of the pine plantations on loamy and sandy soils are now old enough to require pruning and thinning (fig. 7). Improved forest management is needed most on the privately owned land.

Management of the woodland in Barron County varies, depending on the kind of soil. It should be governed by the tree species in the stand, the suitability of the soil for the species, and the objectives of the landowner. The best management alternatives are those that favor the hardwood species through a selection harvest or that favor aspen and birch through an even-aged approach. Even-aged management that favors pine, northern red oak, or sugar maple is desirable if the stand includes significant numbers of these species.

Management should include controlling water erosion, planting trees where regeneration is unreliable, controlling vegetation that competes with natural or artificial regeneration, improving seedling survival, minimizing windthrow on the wetter sites, harvesting in a timely manner, controlling damage by insects and diseases, removing cull trees and other undesirable species, maintaining an optimum basal area, and excluding livestock from the woodland.

Water erosion occurs as a result of site preparation and following logging activities where the soil is exposed along roads and skid trails and on landings. Water erosion is generally a hazard on forest land if the slope is 15 percent or more. Soils that are susceptible to erosion include the steeper Amery, Arland, Chetek, Cress, Dobie, Hayriver, Mahtomedi, Menahga, Newot, Otterholt, Rosholt, Santiago, and Wickware soils. The careful selection of sites for skid trails and roads during harvest helps to minimize erosion.

Soil wetness is the result of a high water table, flooding, or ponding. It causes seedling mortality, limits the use of equipment, results in the invasion or growth of undesirable plants following harvest, and increases the likelihood of windthrow by restricting the rooting depth of some tree species. Wetness is a problem in forested areas of poorly drained and very poorly drained soils, such as Adolph, Auburndale, Barronett, Beseman, Capitola, Fordum, Greenwood, Markey, Newson, Rib, and Seelyeville soils. Harvesting is limited to periods when the soil is frozen. Wetness during the planting season limits reforestation to natural regeneration or hand planting. Wetness also is a problem in spring and in other excessively wet periods on the somewhat poorly drained Almena, Comstock, Magnor, Oesterle, Poskin, and Siouxcreek soils.

Soil droughtiness can also cause seedling mortality. The steeper south- and west-facing slopes can be especially droughty because of the higher temperatures and evaporation rates on these sites. Droughtiness is a problem in areas of Cress, Friendship, Mahtomedi, Menahga, and Plainbo soils. Seedling survival during dry periods can be improved by planting vigorous nursery stock if natural regeneration is unreliable.

Slope, stoniness, and low soil strength can limit the use of forestry equipment. Slopes of 15 percent or more are a limitation. Stones in some areas of Amery, Haugen, and other soils interfere with the use of equipment. In areas where stones or the slope limit the use of equipment, trees can be planted by hand and logs can be yarded by cable. The use of forestry equipment is also restricted on soils that have low strength during the spring thaw period and during periods of high rainfall. Using wheeled vehicles only when the soil is dry or has a thick cover of snow helps to prevent the formation of ruts.

Plant competition is a problem on most of the woodland in the county. Undesirable plants grow where openings are made in the tree canopy. Competition from undesirable plants can hinder or prevent regeneration of the more desirable species. It can be controlled by applications of suitable herbicides, by mechanical removal, or by selective cutting that maintains most of the tree canopy.

Tables 8 and 9 can help woodland owners or forest

Figure 7.—A red pine plantation in an area of Chetek sandy loam, 2 to 6 percent slopes. Trees thinned from pine plantations are used for pulpwood or posts. The remaining trees are pruned and grown for sawlogs.

managers plan the use of soils for wood crops. Only those soils suitable for wood crops are listed.

Table 8 lists the ordination symbol for each soil. Soils assigned the same ordination symbol (based on the same indicator tree species) 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 in a pure stand under natural conditions. The number 1 indicates low potential productivity; 2 or 3, moderate; 4 or 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; *L*, low strength; and *N*, snowpack. 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, L, and N.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed also are subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

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, depth to a seasonal high water table, rock fragments in the upper 20 inches, 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.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

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 50 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 generally is the most common species on the soil and is the one that determines the ordination class. In the map unit descriptions under the heading "Detailed Soil Map Units," the woodland ordination symbol and the indicator species are listed for each map unit that is suitable for production of commercial trees.

Trees to plant are those that are suitable for commercial wood production.

Table 9 gives information about the operation of harvesting or thinning equipment in logging areas and on skid trails, log landings, and haul roads. Ratings are given for the most limiting season. In Barron County, the most limiting season generally is spring. The preferred operating seasons are also indicated. The preferred operating season is the period when the use of forestry equipment causes the least amount of soil damage. This period generally is when the soil is not too wet or when the ground is frozen.

The equipment limitations in the table reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland harvesting and regeneration activities. The chief characteristics and conditions considered in the

ratings are soil wetness, the hazard of flooding, rock outcrops, stones on the surface, texture of the surface layer, slope, depth to hard bedrock, traffic-supporting capacity (or soil strength), and the potential for frost action. Soils that have a moderate or high content of silt have low strength in the extended spring thaw period and during extended periods of high rainfall. Ruts can form easily in areas of these soils during these wet periods.

The ratings of *slight, moderate,* or *severe* in the table are based on the use of conventional equipment and procedures. Special procedures or types of equipment can sometimes be utilized to reduce or overcome the site limitations. If wetness is a limitation, for example, the use of high flotation equipment may prevent the formation of ruts. Restrictions on the use of equipment indicate the need for choosing the right equipment and the need for accurate timing of operations so that seasonal limitations can be avoided. The cost of operations generally increases as the limitations become more severe. The ratings for log landings and haul roads can be used as a guide for establishing them in the least costly locations.

Logging areas and skid trails include areas where some or all of the trees are being cut. Generally, equipment traffic is least intensive in the logging areas. Skid trails, which generally are within the logging area, are roads or trails over which the logs are dragged or hauled from the stump to a log landing. A rating of slight indicates that the use of conventional equipment is not normally restricted by the physical site conditions. A rating of moderate indicates that the use of equipment or the season of use is restricted because of one or more soil factors. A rating of severe indicates that special equipment or techniques are needed to overcome the limitations or that the time of efficient operation is very limited.

Log landings are areas where logs are assembled for transportation. Wheeled equipment may be used more frequently in these areas than in any other areas affected by logging. Considerable soil compaction can be expected in these areas. Good areas for landings require little or no surface preparation or cutting or filling. A rating of slight indicates that the soil is a good site for landings and the area can readily be returned to forest use. A rating of moderate indicates that the season of use is somewhat limited or that such practices as grading, cutting, filling, or drainage are usually required to make the site suitable for a landing and returning the site to forest use is difficult. A rating of severe indicates that the season of use is very limited or that special or expensive techniques are needed to overcome the limitations. There may also be significant risk of environmental damage that makes returning the area to forest use very difficult or impossible.

Haul roads are access roads leading from log landings to primary or surfaced roads. The haul roads serve as transportation routes for wheeled logging equipment. Generally, they are unpaved roads and are not graveled. The wetter soils and the silty upland soils, which are slippery and can be easily rutted during wet periods, commonly provide poor locations for haul roads. A rating of slight indicates that no serious limitations affect the location, construction, and maintenance of haul roads or the season of use. A rating of moderate indicates some limitations, but the limitations generally can be overcome with routine construction techniques. A rating of severe indicates that establishing and maintaining haul roads on that soil are difficult and expensive or that the season of use may be severely restricted.

Site preparation and planting are the mechanized operations for establishing planted trees in an area. The ratings are based on limitations that affect the efficient use of equipment and the risk of damage to the site caused by the equipment. Operating techniques should not displace or remove topsoil from the site or create channels that concentrate storm runoff. A rating of slight indicates that no serious limitations affect site preparation and planting. A rating of moderate indicates that the site conditions prevent the efficient use of the equipment or that the site may be damaged by the equipment. A rating of severe indicates that special equipment or techniques, such as hand planting of trees, are needed to overcome the limitations.

Additional information about woodland management and productivity can be obtained from the Wisconsin Department of Natural Resources or from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Forest Habitat Types

John Kotar, research scientist, Department of Forestry, University of Wisconsin-Madison, helped prepare this section.

The forest habitat type system used in Barron County is derived from a field guide developed for northern Wisconsin (Kotar and others, 1988). The system of habitat classification is based on the concept that plants, including trees, normally occur in predictable patterns or communities and that these communities reflect differences in site characteristics, primarily the moisture content and fertility of the soils. A forest habitat type is an association of dominant tree

and ground flora species in a climax plant community. It encompasses all soils capable of producing similar plant communities at climax, which is the stage in ecological development when the vegetative community becomes stable and perpetuates itself.

The plant community type or association provides the name for the habitat type. The first part of the name represents the dominant climax species adapted to the site. The second part of the name represents one of the characteristic understory species in the climax association. For some soils, two codominant climax tree species or two characteristic understory species are used in the name.

Habitat types have been determined for most of the map units in Barron County. The primary and secondary habitat types are identified at the end of the map unit descriptions in the section "Detailed Soil Map Units." The following paragraphs briefly describe the forest habitat types in the county.

AVDe—Acer/Vaccinium-Desmodium habitat type. The presumed climax overstory in areas of this habitat type is dominated by sugar maple, red maple, red oak, basswood, and white ash. This habitat type is suitable for even-aged management of most early successional species for fiber, wildlife habitat, or other purposes. The potential for white pine is good. Oak stands are common, and the potential for regeneration is good. Sugar maple, basswood, and ironwood grow in areas of this habitat type, but they do not grow well enough to compete successfully with oaks. The understory cover consists of large-leaved aster, hazelnut, brackenfern, ironwood, wild sarsaparilla, hog peanut, and maple-leaved viburnum.

PAm—Pinus/Amphicarpa habitat type. The presumed climax overstory in areas of this habitat type is dominated by white pine, red maple, and red oak. This habitat type is suitable for even-aged management of all early successional species in the region. White pine is the most stable forest type and was the principal species in old-growth stands. Mixtures of oak also make up a high percentage of present stands. Management of mesic hardwoods is not recommended in areas of this habitat type. Understory vegetation consists primarily of hazelwood, brackenfern, large-leaved aster, hog peanut, raspberries, blackberries, low sweet blueberries, juneberry, and red maple.

AAt—Acer/Athyrium habitat type. The presumed climax overstory in areas of this habitat type is dominated by sugar maple, basswood, white ash, red maple, and red oak. Although sugar maple reproduction is dominant in most current stands, oak regeneration also occurs. Oaks respond well where there are openings in the canopy. Maintaining a large oak component in stands in areas of this habitat type is possible in spite of the dominance of sugar maple. Understory vegetation consists primarily of sugar maple, ironwood, hog peanut, hazelnut, large-leaved aster, and wild sarsaparilla.

ACaCi—Acer/Caulophyllum-Circaea habitat type. The presumed climax overstory in areas of this habitat type is dominated by sugar maple, yellow birch, basswood, and white ash. Although sugar maple is the most shade-tolerant species, this competitive advantage does not appear to be sufficient for this species to dominate mature stands. Many current stands are dominated by other hardwood species, such as red oak, white oak, basswood, and red maple; sugar maple makes up only a small percentage of the composition in these stands. Therefore, this habitat type offers the best opportunity for management of northern hardwoods where species other than sugar maple can be favored. Understory vegetation consists primarily of sugar maple, ladyfern, large-leaved aster, Virginia waterleaf, maidenhair fern, and interrupted fern.

QGCe—Quercus/Gaultheria-Ceanothus habitat type. The presumed climax overstory in areas of this habitat type is dominated by pin oak. This habitat type has extremely limited potential for forestry management. Jack pine appears to be the most suitable species in areas of this habitat type. Red pine and white pine seedlings and saplings occur, but they do not grow well. Pure or mixed stands of jack pine and pin oak are the most common cover type. Understory vegetation consists primarily of hazelnut, brackenfern, low sweet blueberries, bur oak and northern pin oak seedlings, and grasses and sedges.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection (fig. 8).

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

Figure 8.—A windbreak of white spruce in an area of Chetek sandy loam, 0 to 2 percent slopes. Soil blowing is a hazard in some cultivated areas of sandy and loamy soils in Barron County.

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 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 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 local office of the Natural Resources Conservation Service, the Wisconsin Department of Natural Resources, or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in

evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, 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 a combination of these.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock 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.

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.

Barron County has a diversity of soils, topography, land uses, and natural plant communities, and thus it supports abundant and varied wildlife populations. Common wildlife species include those associated with the northern forests and with agricultural areas. The following paragraphs describe the kinds of wildlife and wildlife habitat in areas of the major soil associations in Barron County, which are described under the heading "General Soil Map Units."

Some of the associations in the county support mainly woodland vegetation.

Associations 4, 9, and 11.—Areas of these associations are mostly forested. They support northern hardwoods, red oak, and aspen. They also include numerous lakes and associated wetlands, which are utilized by large numbers of waterfowl.

Other common wildlife species are those normally associated with northern forests, including whitetail deer, black bear, coyote, gray squirrel, ruffed grouse, snowshoe hare, woodcock, raccoon, fisher, porcupine, otter, beaver, and a variety of resident and migratory songbirds. Osprey and bald eagle, which are endangered species, also are seen frequently in areas of these associations.

Associations 6, 8, and 10.—Areas of these associations support mostly upland forest vegetation. The main timber types include northern hardwoods, red oak, and aspen. Common wildlife species are whitetail deer, black bear, coyote, gray squirrel, ruffed grouse, raccoon, fisher, porcupine, and a variety of forest-interior songbirds.

The rest of the associations are mostly used as cropland. They are intensively cropped in areas of the most suitable soils. The variety and numbers of wildlife are greatly influenced by the amount of woody cover and wetlands that remain in the areas of cropland. The common wildlife species in these areas include those normally associated with agricultural regions, including whitetail deer, red fox, cottontail rabbit, raccoon, skunk, red-tailed hawk, harrier, kestrel, gray squirrel, fox squirrel, a variety of waterfowl, and numerous songbirds that frequent open fields and small brushy areas.

Association 1.—Areas of this association have large acreages of upland forest because of steep sandstone ridges. Thus, this association supports larger populations of wildlife species associated with the larger woodlots, including ruffed grouse, deer, and gray squirrel.

Association 2.—The flat areas of this association are farmed intensively, but small woodlots are scattered throughout. Also, some large tracts of woodland are in very steep areas in Stanley Township. Many lakes, streams, and associated wetlands in the Chetek area provide habitat for muskrat, mink, beaver, otter, waterfowl, and other wetland wildlife species. Some areas of remnant prairie are in Dovre Township.

Association 3.—Areas of this association are cropped intensively. Seasonally flooded shallow basins were abundant before the soils were drained and cultivated. Important habitat is associated with strips of woodland that still exist along major drainageways. These areas provide important travel corridors for migratory songbirds, woodcock, raptors, and other woodland wildlife species. Red Cedar Lake and the Red Cedar River provide important feeding and nesting habitat for bald eagles and ospreys.

Association 5.—Areas of this association consist of cropland intermixed with woodlots and wetlands. In addition to the wildlife species common to agricultural areas, this association supports ducks and other migratory birds in the shallow marshes south of Almena.

Association 7.—This association consists of cropland in areas that have previously been drained or that are dry enough for cultivation. It also includes numerous tracts of woodland and open wetlands, which provide important habitat for wildlife. Waterfowl, open field passerines, such as meadowlarks, bobolinks, and savannah sparrows, and open country raptors, such as kestrels, harriers, and red-tailed hawks, are common in areas of this association.

In table 12, the soils in Barron County 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 flooding. Soil temperature and soil moisture also are 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, flooding, and slope. Soil temperature and soil moisture also are 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 flooding. Soil temperature and

soil moisture also are considerations. Examples of wild herbaceous plants are curly dock, goldenrod, smartweed, wheatgrass, 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 (fig. 9).

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. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous and/or coniferous plants and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, 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

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. Ratings are given for 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 should 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 kinds 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate

Figure 9.—A wildlife pond in an area of Seelyeville and Cathro mucks, 0 to 1 percent slopes. Areas of shallow water in Barron County provide important habitat for ducks, whitetail deer, muskrats, and many songbirds.

potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and 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 13 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, or other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, 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, and the available water capacity in the upper 40 inches 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 14 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.

The table also shows the suitability of the soils for use as daily cover for landfill. 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.

The table 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 resulting from rapid permeability in 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 should be considered.

The ratings in the table are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench 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 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 the 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 15 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 to 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 have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 15, 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 naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal high 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 16 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 or organic matter. 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 the potential for 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. 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 and by soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control 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, 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 20.

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 to 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.

Engineering Index Properties

Table 17 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. 10). "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 (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

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

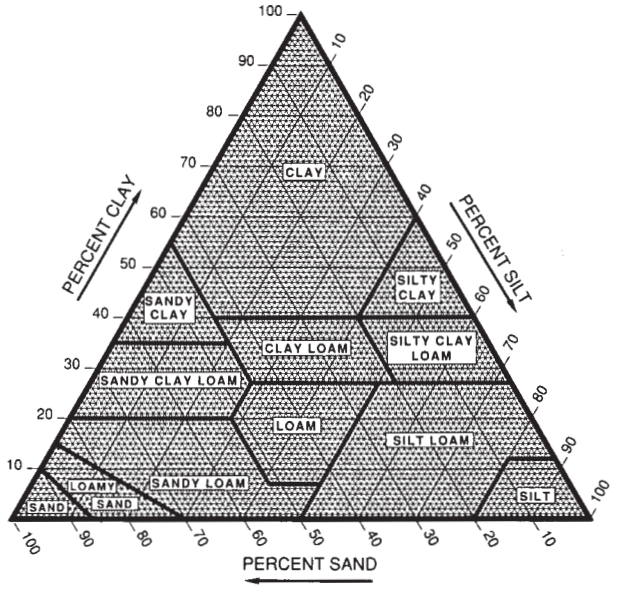

Figure 10.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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 20.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 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.

Depth to the upper and lower boundaries of each layer is indicated.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In the 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, 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 the soil is dried at 105 degrees C. In table 18, 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 and septic tank absorption fields.

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 retention of water and 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 the basis of 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 classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; *high*, more than 6 percent; and *very high*, greater than 9 percent.

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 0.02 to 0.64. Other factors being equal, 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. The soils assigned to group 1 are the most susceptible to soil blowing, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, 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 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, 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 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 the table, 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, and water standing in swamps and marshes is considered ponding rather than flooding.

The table 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 (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

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 little or no horizon development.

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 estimates are based mainly on observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in the table are depth to the seasonal high water table, the kind of water table, 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 the table.

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.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

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 generally 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. The table shows the expected total subsidence, which usually is a result of drainage and oxidation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and

depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 20 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 Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); and Unified classification—D 2487 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1999). 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 21 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; type of saturation; 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 are in cool climates).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup 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 taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Eutric 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, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed Eutric Glossoboralfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. 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" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1999). Unless otherwise indicated, 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."

Adolph Series

The Adolph series consists of very poorly drained soils on ground moraines. These soils are moderately deep or deep to dense till. They formed in silty alluvium and in the underlying dense sandy loam glacial till. Permeability is moderate in the subsoil and very slow in the substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Adolph silt loam, 0 to 2 percent slopes, 1,740 feet north and 2,140 feet east of the southwest corner of sec. 33, T. 34 N., R. 10 W.

A—0 to 13 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; friable; many medium and fine roots; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation; moderately acid; abrupt wavy boundary.

Bg1—13 to 19 inches; grayish brown (2.5Y 5/2) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation; moderately acid; clear wavy boundary.

Bg2—19 to 30 inches; grayish brown (2.5Y 5/2) silt loam; moderate medium subangular blocky structure; friable; few fine roots; many coarse prominent strong brown (7.5YR 5/8) masses of iron accumulation; moderately acid; clear wavy boundary.

2BCg—30 to 36 inches; grayish brown (10YR 5/2) sandy loam; moderate coarse subangular blocky structure; friable; many medium prominent reddish brown (5YR 4/4) masses of iron accumulation; about 10 percent gravel; moderately acid; abrupt wavy boundary.

2Cd—36 to 60 inches; reddish brown (5YR 4/4) sandy loam; common medium prominent light brownish gray (10YR 6/2) iron depletions; massive; firm; about 10 percent gravel; moderately acid.

The thickness of the solum and the depth to dense till (Cd horizon) range from 30 to 50 inches. The thickness of the mollic epipedon ranges from 10 to 18 inches. The thickness of the silty mantle ranges from 18 to 34 inches.

The A horizon has value of 2 or 3. The Bg horizon has hue of 10YR, value of 4 or 5, and chroma of 1, or it has hue of 2.5Y, value of 4 or 5, and chroma of 1 or 2. The 2BCg horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2, or it has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 3 or 4. It is sandy loam or gravelly sandy loam. The 2C horizon has value of 3 to 6 and chroma of 3 or 4. It is sandy loam or gravelly sandy loam. The content of gravel and cobbles in the 2B and 2C horizons ranges from 5 to 20 percent.

Aftad Series

The Aftad series consists of very deep, moderately well drained soils on glacial lake plains. These soils formed in loamy alluvium and in silty lacustrine deposits. Permeability is moderate. Slope ranges from 0 to 3 percent.

Typical pedon of Aftad fine sandy loam, 0 to 3 percent slopes, 2,240 feet south and 740 feet east of the northwest corner of sec. 9, T. 35 N., R. 14 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine and medium roots; about 4 percent gravel; neutral; abrupt smooth boundary.

E—9 to 11 inches; brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry; moderate thick platy structure; friable; few fine roots; about 5 percent gravel; slightly acid; clear smooth boundary.

E/B—11 to 18 inches; about 70 percent brown (10YR 5/3) fine sandy loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark yellowish brown (10YR 4/4) fine sandy loam (Bt); moderate medium subangular blocky structure; friable; few distinct dark brown (7.5YR 3/3) clay films on faces of peds; few fine roots; about 5 percent gravel; slightly acid; clear wavy boundary.

B/E—18 to 22 inches; about 70 percent dark brown (7.5YR 4/4) loam (Bt); moderate medium subangular blocky structure; friable; common faint dark brown (7.5YR 3/3) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) loam (E), very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; friable; few fine roots; about 5 percent gravel; moderately acid; clear smooth boundary.

Bt1—22 to 32 inches; dark brown (7.5YR 4/4) loam; common medium distinct strong brown (7.5YR 5/8) Fe concentrations; moderate medium subangular blocky structure; friable; common faint dark brown (7.5YR 3/3) clay films on faces of peds; about 5 percent gravel; moderately acid; abrupt smooth boundary.

2Bt2—32 to 44 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common faint dark brown (7.5YR 3/3) clay films on faces of peds; common distinct brown (7.5YR 5/2) coatings of silt grains on faces of some peds; common medium distinct strong brown (7.5YR 5/8) masses of iron accumulation; strongly acid; clear smooth boundary.

2C—44 to 60 inches; dark brown (7.5YR 4/4) silt loam; massive; friable; few medium distinct strong brown (7.5YR 5/6) masses of iron accumulation; strongly acid.

The thickness of the solum ranges from 35 to 54 inches. Depth to the 2B horizon ranges from 20 to 40 inches. Masses of iron accumulation are in the subsoil within a depth of 40 inches. The volume of gravel ranges from 3 to 10 percent throughout.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 2 or 3. It is loamy sand, sandy loam, or fine sandy loam. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon. The Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, fine sandy loam, or loam. The 2Bt and 2C horizons have hue of 7.5YR or 10YR and value and chroma of 4 to 6.

Almena Series

The Almena series consists of very deep, somewhat poorly drained soils on ground moraines. These soils formed in loess or water-laid silty deposits and in the underlying sandy loam or loam glacial till. Permeability is moderate in the silty mantle and moderate or moderately slow in the till. Slope ranges from 0 to 3 percent.

Typical pedon of Almena silt loam, 0 to 3 percent slopes, 1,500 feet north and 200 feet west of the southeast corner of sec. 30, T. 35 N., R. 11 W.

Ap—0 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; few fine roots; strongly acid; abrupt smooth boundary.

E—14 to 16 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; moderately acid; clear wavy boundary.

E/B—16 to 22 inches; about 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few fine roots; common fine prominent strong brown (7.5YR 5/6) masses of iron accumulation; moderately acid; clear wavy boundary.

B/E—22 to 27 inches; about 70 percent dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common distinct strong brown (7.5YR 4/6) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; common fine distinct and prominent strong brown (7.5YR 5/6) masses of iron accumulation and brown (7.5YR 4/2) iron depletions; very strongly acid; clear wavy boundary.

Bt1—27 to 32 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark brown (7.5YR 4/2) clay films on faces of peds; common medium prominent light brownish gray (10YR 6/2) iron depletions and common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation; very strongly acid; clear wavy boundary.

Bt2—32 to 48 inches; dark brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; friable; few distinct dark brown (7.5YR 4/2) clay films on faces of peds; common medium distinct pinkish gray (7.5YR 6/2) iron depletions and strong brown (7.5YR 5/6) masses of iron accumulation; very strongly acid; clear wavy boundary.

2Bt3—48 to 55 inches; dark brown (7.5YR 4/4) sandy loam; weak medium and coarse subangular blocky structure; friable; few distinct strong brown (7.5YR 4/6) clay films on faces of peds; common medium prominent light brownish gray (10YR 6/2) iron depletions and strong brown (7.5YR 5/6) masses of iron accumulation; about 10 percent gravel; very strongly acid; clear wavy boundary.

2C—55 to 60 inches; yellowish red (5YR 4/6) sandy loam; massive; friable; about 10 percent gravel; very strongly acid.

The thickness of the solum ranges from 30 to more than 60 inches. The thickness of the silty mantle and the depth to till range from 36 to 60 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon. This horizon has hue of 10YR and value and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon. The Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. Some pedons have a Btg horizon. This horizon dominantly has chroma of 2 below the upper 10 inches of the argillic horizon. The 2Bt and 2C horizons have hue of 2.5YR, 5YR, or 7.5YR and value and chroma of 4 to 6. They are loam or sandy loam or the gravelly analogs of these textures.

Amery Series

The Amery series consists of well drained soils on moraines. These soils are deep or very deep to dense till. They formed in mostly loamy glacial mudflow sediment and in the underlying dense sandy loam glacial till (fig. 11). Permeability is moderate in the upper part of the subsoil, moderately slow in the lower part of the subsoil, and slow or very slow in the substratum. Slope ranges from 12 to 35 percent.

Typical pedon of Amery sandy loam, 12 to 25 percent slopes, 300 feet north and 500 feet west of the southeast corner of sec. 20, T. 36 N., R. 10 W.

A—0 to 3 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many fine and very fine and few medium and coarse roots; about 10 percent gravel and 2 percent cobbles; very strongly acid; abrupt smooth boundary.

Bw—3 to 22 inches; yellowish brown (10YR 5/4) sandy loam; moderate medium subangular blocky structure; friable; many fine and very fine and few medium and coarse roots; about 12 percent gravel and 2 percent cobbles; very strongly acid; clear smooth boundary.

E/B—22 to 34 inches; about 60 percent brown (7.5YR 5/3) sandy loam (E), pink (7.5YR 7/3) dry; moderate medium subangular blocky structure; friable; tonguing into or surrounding remnants of dark brown (7.5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few faint dark brown (7.5YR 3/4) clay films on faces of peds; common fine and very fine and few medium roots; about 10 percent gravel and 2 percent cobbles; strongly acid; clear smooth boundary.

B/E—34 to 41 inches; about 70 percent reddish brown (5YR 4/4) gravelly sandy loam (Bt); moderate medium subangular blocky structure; friable; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; penetrated by tongues of reddish brown (5YR 5/3) sandy loam (E), pink (5YR 7/3) dry; moderate medium subangular blocky structure; friable; few fine and very fine roots; about 14 percent gravel and 2 percent cobbles; strongly acid; clear smooth boundary.

Bt1—41 to 57 inches; reddish brown (5YR 4/4) gravelly sandy loam; moderate medium subangular blocky structure; friable; few fine and very fine roots; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; about 14 percent gravel and 2 percent cobbles; strongly acid; clear smooth boundary.

Bt2—57 to 71 inches; reddish brown (5YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; few very fine roots; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; about 12 percent gravel and 2 percent cobbles; moderately acid; clear smooth boundary.

Cd—71 to 80 inches; reddish brown (5YR 4/4) sandy loam; massive; firm; about 12 percent gravel and 2 percent cobbles; slightly acid.

Figure 11.—Profile of Amery sandy loam. This well drained soil is on moraines. Depth is marked in feet.

The thickness of the solum is more than 40 inches. Depth to the Cd horizon is more than 60 inches. The volume of gravel ranges from 0 to 15 percent in the solum and from 5 to 30 percent in the substratum. The volume of cobbles ranges from about 0 to 3 percent in the upper part of the solum and from 1 to 6 percent in the lower part of the solum and in the substratum.

The Ap or A horizon has value of 2 to 4 and chroma of 1 to 3. The Bw horizon has value of 3 to 5 and

chroma of 3 to 6. It is sandy loam, loam, or the gravelly analogs of these textures. The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is loam, loamy sand, sandy loam, or the gravelly analogs of these textures. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is sandy loam, fine sandy loam, or the gravelly analogs of these textures. Some pedons that have a B/E horizon do not have a Bt horizon.

Anigon Series

The Anigon series consists of very deep, well drained soils on outwash plains. These soils are moderately deep to sandy outwash. They formed mostly in loess or silty alluvium and in loamy alluvium underlain by sandy outwash (fig. 12). Permeability is moderate in the upper part of the subsoil, moderately rapid or rapid in the lower part of the subsoil, and rapid or very rapid in the substratum. Slope ranges from 0 to 12 percent.

Typical pedon of Anigon silt loam, 0 to 2 percent slopes, 75 feet south and 1,300 feet east of the northwest corner of sec. 20, T. 35 N., R. 13 W.

Ap—0 to 5 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many medium and fine roots; moderately acid; abrupt smooth boundary.

E—5 to 7 inches; pale brown (10YR 6/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; many fine and medium roots; moderately acid; clear smooth boundary.

E/B—7 to 12 inches; about 70 percent pale brown (10YR 6/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few fine and medium roots; very strongly acid; clear wavy boundary.

B/E—12 to 18 inches; about 70 percent dark brown (7.5YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; few distinct dark brown (7.5YR 4/2) clay films on faces of peds; penetrated by tongues of brown (7.5YR 5/4) silt loam (E), pink (7.5YR 7/4) dry; moderate medium platy structure; friable; very strongly acid; clear smooth boundary.

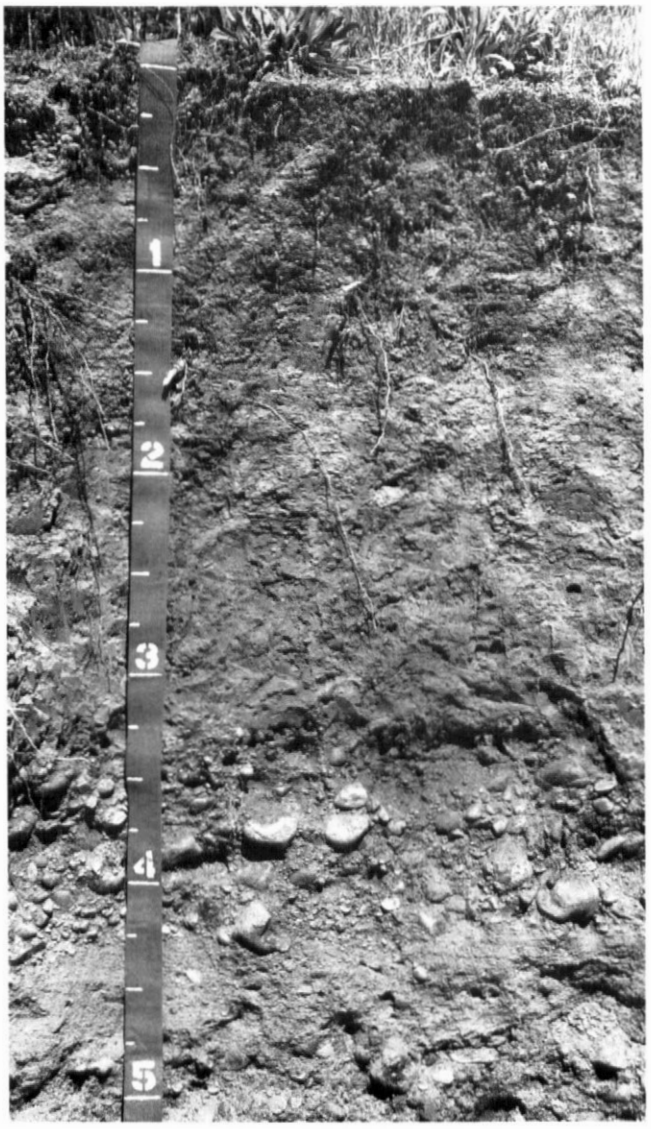

Figure 12.—Profile of Anigon silt loam. This well drained soil is on outwash plains. Depth is marked in feet.

Bt1—18 to 33 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few distinct dark brown (7.5YR 4/2) clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bt2—33 to 37 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; common distinct dark brown (7.5YR 4/2) clay films on faces of peds; about 10 percent gravel; very strongly acid; abrupt smooth boundary.

2C—37 to 60 inches; strong brown (7.5YR 5/6), stratified very gravelly sand and sand; single grain;

loose; about 35 percent gravel and 5 percent cobbles (as an average); strongly acid.

The thickness of the solum and the thickness of the silty mantle range from 20 to 40 inches.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loam, sandy loam, or the gravelly analogs of these textures. The 2C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is stratified sand and coarse sand or the gravelly or very gravelly analogs of these textures.

Arland Series

The Arland series consists of well drained soils on uplands. These soils are moderately deep to sandstone. They formed in loamy glacial till or in loess and loamy glacial till underlain by sandstone or by sandy residuum and sandstone. Permeability is moderate or moderately rapid in the silty or loamy mantle and moderately slow or moderate in the sandstone. Slope ranges from 2 to 25 percent.

Typical pedon of Arland fine sandy loam, 6 to 12 percent slopes, eroded, 500 feet south and 400 feet west of the northeast corner of sec. 26, T. 33 N., R. 10 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; common fine roots; some brown (7.5YR 4/3) soil mixed in by plowing; about 1 percent gravel; slightly acid; abrupt smooth boundary.

E—8 to 10 inches; brown (7.5YR 4/3) sandy loam, pink (7.5YR 7/3) dry; weak medium platy structure; friable; few fine roots; some very dark grayish brown (10YR 3/2) soil in worm channels and root channels; about 1 percent gravel; moderately acid; clear smooth boundary.

E/B—10 to 15 inches; about 80 percent brown (7.5YR 4/3) sandy loam (E), pink (7.5YR 7/3) dry; weak medium platy structure; friable; tonguing into and surrounding remnants of reddish brown (5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few fine roots; few distinct dark brown (7.5YR 3/3) clay films on faces of peds and in pores; about 2 percent gravel; moderately acid; clear smooth boundary.

B/E—15 to 23 inches; about 55 percent reddish brown (5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; common distinct dark brown (7.5YR 3/3) clay films on faces of peds and in pores; penetrated by tongues of brown (7.5YR 4/3) sandy loam (E), pink (7.5YR 7/3) dry; moderate medium subangular blocky structure; friable; few fine roots; about 4 percent gravel; strongly acid; clear wavy boundary.

Bt—23 to 36 inches; reddish brown (5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark brown (7.5YR 3/3) clay films on faces of peds and in pores; about 6 percent gravel; strongly acid; clear smooth boundary.

2Cr—36 to 60 inches; yellowish brown (10YR 5/6) sandstone.

The thickness of the solum and the depth to weakly cemented sandstone range from 20 to 40 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A horizon. This horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Ap or A horizon is fine sandy loam or silt loam. 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. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon. The Bt part has hue of 5YR, 7.5YR, or 10YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, fine sandy loam, loam, or silt loam. The Bt horizon has colors similar to those of the Bt part of the E/B or B/E horizon. The Bt horizon is typically sandy loam or loam, but in some pedons it is silt loam in the upper part. The 2C horizon, if it occurs, has hue of 7.5YR or 10YR and value and chroma of 2 to 8. It is sand, fine sand, or loamy sand.

Auburndale Series

The Auburndale series consists of very deep, poorly drained soils on ground moraines. These soils formed in loess or silty alluvium underlain by sandy loam glacial till. Permeability is moderate in the silty mantle and moderately slow or moderate in the till. Slope ranges from 0 to 2 percent.

Typical pedon of Auburndale silt loam, 0 to 2 percent slopes, 300 feet south and 1,100 feet west of the northeast corner of sec. 32, T. 35 N., R. 10 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate

medium granular structure; friable; many fine and few medium roots; slightly acid; clear smooth boundary.

Eg—5 to 12 inches; gray (10YR 5/1) silt loam, light gray (10YR 7/1) dry; moderate medium platy structure; friable; many fine and few medium roots; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation; slightly acid; clear smooth boundary.

Btg1—12 to 18 inches; grayish brown (10YR 5/2) silt loam; moderate medium and fine subangular blocky structure; friable; common fine and few medium roots; few distinct dark brown (7.5YR 4/2) clay films on faces of peds; common fine and medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; moderately acid; clear wavy boundary.

Btg2—18 to 32 inches; grayish brown (10YR 5/2) silt loam; moderate fine and medium subangular blocky structure; friable; common fine roots; common distinct dark brown (7.5YR 4/2) and few distinct black (10YR 2/1) clay films on faces of peds and in pores; many fine and medium prominent yellowish brown (10YR 5/8) masses of iron accumulation; moderately acid; clear wavy boundary.

Btg3—32 to 40 inches; grayish brown (10YR 5/2) silt loam; moderate medium coarse subangular blocky structure; friable; few fine roots; common distinct dark brown (7.5YR 4/2) and few prominent black (N 2/0) clay films on faces of peds and in pores; common fine and medium prominent yellowish brown (10YR 5/8) masses of iron accumulation and common fine faint gray (10YR 5/1) iron depletions; strongly acid; clear wavy boundary.

Btg4—40 to 46 inches; grayish brown (10YR 5/2) silt loam; weak coarse subangular blocky structure; friable; few fine roots; common distinct dark brown (7.5YR 4/2) clay films on faces of peds and in pores; few prominent black (N 2/0) clay films in pores; common fine distinct strong brown (7.5YR 5/6) masses of iron accumulation and common fine faint gray (10YR 5/1) iron depletions; moderately acid; clear smooth boundary.

2C—46 to 60 inches; dark brown (7.5YR 4/4) sandy loam; massive; friable; many fine and medium distinct strong brown (7.5YR 5/8) masses of iron accumulation and common medium distinct brown (7.5YR 5/2) iron depletions; about 7 percent gravel; moderately acid.

The thickness of the solum ranges from 40 to more than 60 inches. The thickness of the silty mantle ranges from 36 to 60 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Eg horizon has value of 4 to 6 and chroma of 1 or 2. The Btg horizon has hue of 7.5YR, 10YR, or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. Some pedons have a 2Bt or 2BC horizon. This horizon has colors and textures similar to those of the 2C horizon. The 2C horizon has hue of 5YR or 7.5YR and value and chroma of 3 to 6. It is sandy loam or loam or the gravelly analogs of these textures.

Barronett Series

The Barronett series consists of very deep, poorly drained soils on glacial lake plains. These soils formed in silty lacustrine deposits. Permeability is moderate in the solum and moderately slow in the substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Barronett silt loam, 0 to 2 percent slopes, 250 feet north and 1,500 feet east of the southwest corner of sec. 21, T. 35 N., R. 14 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many medium and fine roots; strongly acid; abrupt smooth boundary.

Eg—8 to 13 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; moderate medium platy structure; friable; common fine roots; common medium prominent strong brown (7.5YR 5/8) masses of iron accumulation; strongly acid; clear smooth boundary.

Btg1—13 to 22 inches; light brownish gray (10YR 6/2) silt loam; weak medium and fine subangular blocky structure; friable; few fine roots; many medium prominent strong brown (7.5YR 5/8) masses of iron accumulation; common faint grayish brown (10YR 5/2) clay films in root channels; very strongly acid; clear smooth boundary.

Btg2—22 to 32 inches; light brownish gray (2.5Y 6/2) silt loam; moderate coarse prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; common distinct grayish brown (10YR 5/2) clay films in root channels; many coarse prominent strong brown (7.5YR 5/8) masses of iron accumulation; very strongly acid; clear smooth boundary.

Btg3—32 to 36 inches; light brownish gray (2.5Y 6/2) silt loam; moderate coarse subangular blocky structure; friable; few fine roots; few distinct grayish brown (10YR 5/2) clay films on faces of peds; many coarse prominent yellowish red (5YR

5/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

C—36 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; massive; friable; common medium prominent yellowish red (5YR 5/6) masses of iron accumulation; very strongly acid.

The thickness of the solum ranges from 25 to 45 inches.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Eg horizon has value of 4 to 6 and chroma of 1 or 2. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silt loam or silty clay loam. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is silt loam, or it is silt loam that has strata of loam, very fine sandy loam, very fine sand, or fine sand.

Beseman Series

The Beseman series consists of very deep, very poorly drained soils in depressions on ground moraines and lacustrine basins. These soils formed in decomposed organic material underlain by silty or loamy alluvium. Permeability is moderate or moderately rapid in the organic layers and moderately slow in the substratum. Slope is 0 to 1 percent.

Typical pedon of Beseman peat, 0 to 1 percent slopes, 2,040 feet north and 2,440 feet east of the southwest corner of sec. 19, T. 36 N., R. 14 W.

Oi—0 to 3 inches; peat, dark brown (7.5YR 3/2) broken face, pressed, and rubbed; about 90 percent fiber, 80 percent rubbed; massive; nonsticky; very strongly acid (pH 5.0 in water); abrupt wavy boundary.

Oa1—3 to 11 inches; muck, black (N 2/0) broken face, pressed, and rubbed; about 40 percent fiber, 10 percent rubbed; moderate medium subangular blocky structure; slightly sticky; herbaceous fiber; very strongly acid (pH 4.5 in water); clear wavy boundary.

Oa2—11 to 23 inches; muck, dark reddish brown (5YR 2/2) broken face, pressed, and rubbed; about 20 percent fiber, 8 percent rubbed; moderate medium subangular blocky structure; slightly sticky; herbaceous fiber; very strongly acid (pH 4.5 in water); abrupt smooth boundary.

Oa3—23 to 31 inches; muck, dark reddish brown (5YR 2/2) broken face, pressed, and rubbed; about 20 percent fiber, trace rubbed; moderate coarse subangular blocky structure; slightly sticky; herbaceous fiber; very strongly acid (pH 4.5 in water); clear wavy boundary.

Cg1—31 to 37 inches; very dark grayish brown (10YR 3/2) silt loam; massive; friable; very strongly acid; clear wavy boundary.

Cg2—37 to 60 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; very strongly acid.

The thickness of the organic material ranges from 16 to 51 inches. The organic material is dominantly muck, but some pedons have thin layers of mucky peat or peat with a combined thickness of less than 10 inches.

Some pedons have a surface layer of sphagnum moss less than 8 inches thick. The muck has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. The Cg horizon has hue of 5YR, 7.5YR, 10YR, or 2.5Y, value of 3 to 5, and chroma of 1 to 4. It is sandy loam, loam, or silt loam.

Brill Series

The Brill series consists of very deep, moderately well drained soils on outwash plains and stream terraces. These soils are moderately deep to sandy outwash. They formed mostly in loess or silty alluvium underlain by stratified sandy outwash. Permeability is moderate in the silty mantle, moderate or moderately rapid in the loamy lower part of the subsoil, and rapid or very rapid in the sand and gravel substratum. Slope ranges from 0 to 3 percent.

Typical pedon of Brill silt loam, 0 to 3 percent slopes, 2,340 feet south and 1,040 feet west of the northeast corner of sec. 16, T. 35 N., R. 10 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

E—7 to 11 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; common fine roots; slightly acid; clear wavy boundary.

E/B—11 to 19 inches; about 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few faint dark brown (10YR 3/3) clay films on faces of peds; few fine roots; moderately acid; clear wavy boundary.

Bt1—19 to 34 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few distinct dark brown (10YR 3/3) clay films on faces of peds; few fine prominent yellowish brown (10YR 5/6)

masses of iron accumulation; strongly acid; clear wavy boundary.

2Bt2—34 to 38 inches; dark brown (7.5YR 4/4) loam; moderate coarse subangular blocky structure; friable; few fine roots; few distinct dark brown (10YR 3/3) clay films on faces of peds; common medium distinct strong brown (7.5YR 5/8) masses of iron accumulation; strongly acid; clear smooth boundary.

3C—38 to 60 inches; yellowish red (5YR 4/6), stratified gravelly sand and sand; single grain; loose; about 25 percent gravel (as an average); very strongly acid.

The thickness of the solum, the thickness of the silty mantle, and the depth to sand and gravel range from 24 to 40 inches.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. The 2Bt horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, loam, or the gravelly analogs of these textures. Some pedons have a 3Bt horizon. This horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loamy sand, loamy coarse sand, or the gravelly or very gravelly analogs of these textures. The 2C horizon has colors similar to those of the 3Bt horizon. The 2C horizon is stratified sand or coarse sand or the gravelly or very gravelly analogs of these textures.

Campia Series

The Campia series consists of very deep, well drained soils on glacial lake plains. These soils formed in mostly silty lacustrine deposits. Permeability is moderate in the subsoil and moderately slow in the substratum. Slope ranges from 6 to 12 percent.

Typical pedon of Campia silt loam, 6 to 12 percent slopes, eroded, 2,200 feet north and 200 feet west of the southeast corner of sec. 18, T. 36 N., R. 14 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

E/B—9 to 14 inches; about 60 percent brown (7.5YR 5/2) silt loam (E), pinkish gray (7.5YR 6/2) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few fine roots; moderately acid; clear wavy boundary.

B/E—14 to 19 inches; about 70 percent dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few prominent yellowish red (5YR 4/6) clay films on faces of peds; penetrated by tongues of brown (7.5YR 5/2) silt loam (E), pinkish gray (7.5YR 6/2) dry; moderate medium platy structure; friable; few fine roots; very strongly acid; clear wavy boundary.

Bt1—19 to 26 inches; reddish brown (5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct yellowish red (5YR 4/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—26 to 34 inches; reddish brown (5YR 4/4) silt loam; moderate coarse subangular blocky structure; friable; few fine roots; few distinct yellowish red (5YR 4/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

C—34 to 60 inches; reddish brown (5YR 5/4) silt loam; massive; friable; moderately acid.

The thickness of the solum ranges from 30 to 45 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon, which has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an E horizon. This horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. Some pedons have thin strata of silty clay loam, silt, or very fine sand in the lower part of the Bt horizon or in the C horizon, or both.

Capitola Series

The Capitola series consists of very deep, poorly drained soils on ground moraines. These soils formed in silty alluvium and in the underlying sandy loam glacial till. Permeability is moderate in the subsoil and moderately slow in the substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Capitola muck, 0 to 2 percent slopes, 700 feet north and 1,700 feet east of the southwest corner of sec. 14, T. 34 N., R. 10 W.

Oa—0 to 3 inches; muck, black (N 2/0) broken face and rubbed; about 30 percent fiber, 10 percent rubbed; moderate medium subangular blocky structure; very friable; common fine and medium roots; primarily herbaceous fibers; about 3 percent cobbles; moderately acid; clear smooth boundary.

A—3 to 7 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; common fine and medium roots; about 3 percent cobbles; strongly acid; abrupt smooth boundary.

Bg—7 to 11 inches; dark grayish brown (2.5Y 4/2) silt loam; moderate medium subangular blocky structure; friable; common fine and medium roots; about 3 percent cobbles; strongly acid; clear smooth boundary.

Btg1—11 to 17 inches; light brownish gray (2.5Y 6/2) silt loam; moderate medium subangular blocky structure; friable; few fine and medium roots; few faint olive brown (2.5Y 4/3) clay films on faces of peds; few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation; about 3 percent cobbles; strongly acid; clear smooth boundary.

Btg2—17 to 27 inches; light brownish gray (2.5Y 6/2) silt loam; moderate medium subangular blocky structure; friable; few fine and medium roots; common faint olive brown (2.5Y 4/3) clay films on faces of peds; many medium prominent yellowish brown (10YR 5/6) masses of iron accumulation; about 3 percent cobbles; strongly acid; clear smooth boundary.

2Btg3—27 to 36 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common faint brown (7.5YR 4/3) clay films on faces of peds; common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation and brown (7.5YR 5/2) masses of iron depletion; about 10 percent gravel and 3 percent cobbles; strongly acid; clear smooth boundary.

2C—36 to 60 inches; dark brown (7.5YR 4/4) sandy loam; massive; friable; few medium distinct strong brown (7.5YR 5/6) masses of iron accumulation; about 10 percent gravel and 3 percent cobbles; moderately acid.

The thickness of the solum ranges from 20 to 40 inches. The thickness of the silty mantle ranges from 0 to 36 inches.

The Oa horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bg and Btg horizons have hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The 2Btg horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 4 to 6, and chroma of 1 to 4. It is sandy loam or gravelly sandy loam. The 2C horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 6, and chroma of 2 to 4. It is sandy loam or gravelly sandy loam. The volume of gravel ranges from 5 to 30 percent in the 2Btg and 2C horizons. The volume of cobbles ranges from 0 to 5 percent throughout the profile.

Cathro Series

The Cathro series consists of very deep, very poorly drained soils in depressions and slightly concave areas on outwash plains and ground moraines. These soils formed in 16 to 51 inches of herbaceous organic material underlain by loamy sediments. Permeability is moderately slow to moderately rapid in the organic layers and moderate in the mineral soil. Slope is 0 to 1 percent.

Typical pedon of Cathro muck, in an area of Seelyeville and Cathro mucks, 0 to 1 percent slopes, 1,720 feet south and 2,500 feet east of the northwest corner of sec. 3, T. 33 N., R. 10 W.

Oa1—0 to 16 inches; muck, very dark brown (10YR 2/2) broken face, pressed, and rubbed; about 20 percent fiber, 5 percent rubbed; moderate medium granular structure; nonsticky; herbaceous fibers; strongly acid (pH 5.5 in water); clear smooth boundary.

Oa2—16 to 30 inches; muck, very dark brown (10YR 2/2) broken face, pressed, and rubbed; about 10 percent fiber, trace rubbed; weak medium subangular blocky structure; slightly sticky; herbaceous fibers; strongly acid (pH 5.5 in water); clear smooth boundary.

Cg—30 to 60 inches; dark gray (10YR 4/1) silt loam; massive; friable; moderately acid.

The thickness of the organic material ranges from 16 to 51 inches. The organic material is typically muck, but some pedons have thin layers of mucky peat or peat with a combined thickness of less than 10 inches.

The organic material has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The Cg horizon has hue of 5YR, 7.5YR, 10YR, or 2.5Y, value of 3 to 5, and chroma of 1 to 4. It is silt loam, loam, or sandy loam.

Chetek Series

The Chetek series consists of very deep, somewhat excessively drained soils on outwash plains and stream terraces. These soils are shallow to stratified sandy outwash. They formed in loamy alluvium and in the underlying sandy outwash (fig. 13). Permeability is

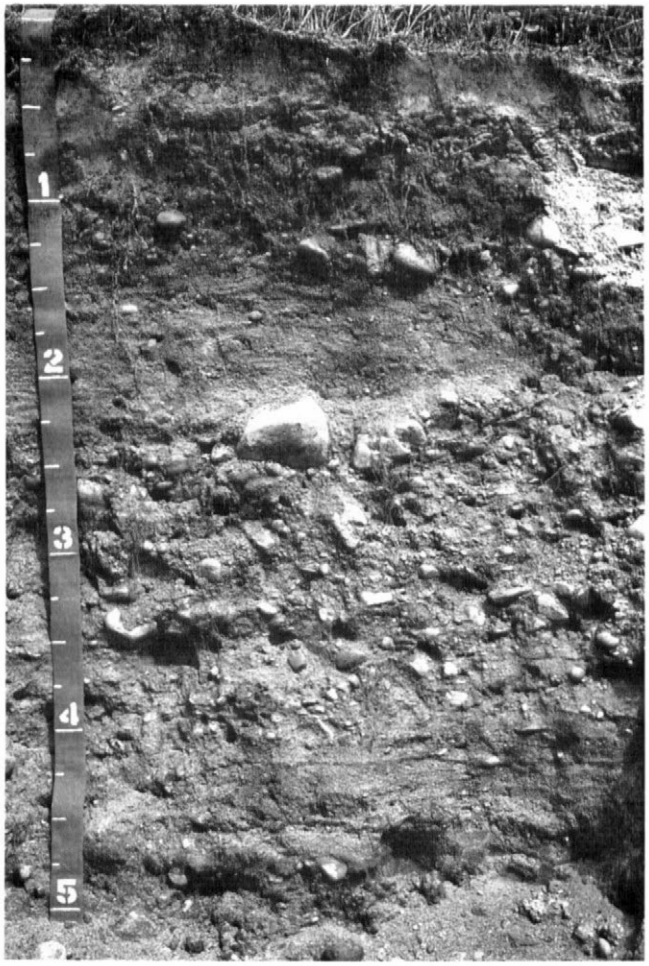

Figure 13.—Profile of Chetek sandy loam. This soil is a probable source of sand and gravel. Depth is marked in feet.

moderate or moderately rapid in the loamy subsoil and rapid or very rapid in the sandy outwash. Slope ranges from 0 to 25 percent.

Typical pedon of Chetek sandy loam, 2 to 6 percent slopes, 100 feet south and 650 feet west of the northeast corner of sec. 36, T. 33 N., R. 10 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; common fine roots; about 10 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—10 to 16 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct reddish brown (5YR 4/4) clay films on faces of peds and clay bridges between sand grains; about 10 percent gravel; moderately acid; clear smooth boundary.

2Bt2—16 to 20 inches; reddish brown (5YR 4/4) gravelly loamy sand; weak medium subangular blocky structure; very friable; clay bridges between sand grains; about 20 percent gravel; strongly acid; clear smooth boundary.

2C—20 to 60 inches; yellowish brown (10YR 5/6), stratified gravelly sand and sand; single grain; loose; about 20 percent gravel (as an average); strongly acid.

The thickness of the solum ranges from 16 to 24 inches. The thickness of the loamy alluvium ranges from 12 to 20 inches.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3. Some pedons have an E horizon, which has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. It is sandy loam or loam. The 2Bt horizon has hue of 5YR or 7.5YR and value and chroma of 4 to 6. It is sand, coarse sand, loamy sand, loamy coarse sand, or the gravelly or very gravelly analogs of these textures. The 2C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sand, coarse sand, or the gravelly or very gravelly analogs of these textures. The content of gravel ranges from 15 to 35 percent in the 2Bt and 2C horizons.

Comstock Series

The Comstock series consists of very deep, somewhat poorly drained soils on glacial lake plains. These soils formed in silty lacustrine deposits. Permeability is moderate in the subsoil and moderately slow in the substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Comstock silt loam, 0 to 2 percent slopes, 1,440 feet south and 2,240 feet east of the northwest corner of sec. 28, T. 35 N., R. 14 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

E—9 to 12 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine and medium roots; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation and few medium distinct light brownish gray (10YR 6/2) iron depletions; strongly acid; clear smooth boundary.

E/B—12 to 18 inches; about 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing

into or surrounding remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few fine roots; few faint dark brown (10YR 4/3) clay films on faces of peds; common medium faint and distinct light brownish gray (10YR 6/2) iron depletions and many coarse prominent strong brown (7.5YR 5/6) masses of iron accumulation; strongly acid; clear wavy boundary.

B/E—18 to 26 inches; about 80 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common faint dark brown (10YR 4/3) clay films on faces of peds; friable; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; common medium distinct and faint light brownish gray (10YR 6/2) iron depletions and many coarse prominent strong brown (7.5YR 5/6) masses of iron accumulation; strongly acid; clear wavy boundary.

Bt1—26 to 34 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common faint dark brown (10YR 4/3) clay films on faces of peds; many medium prominent strong brown (7.5YR 5/6) masses of iron accumulation and common medium distinct grayish brown (10YR 5/2) iron depletions; strongly acid; clear wavy boundary.

Bt2—34 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; moderate coarse subangular blocky structure; friable; few fine roots; few faint dark brown (10YR 4/3) clay films on faces of peds; many medium prominent strong brown (7.5YR 5/6) masses of iron accumulation and common medium distinct grayish brown (10YR 5/2) iron depletions; strongly acid; clear wavy boundary.

C—40 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; many medium prominent strong brown (7.5YR 5/6) masses of iron accumulation and few fine distinct light brownish gray (10YR 6/2) iron depletions; few thin strata of very fine sand; moderately acid.

The thickness of the solum ranges from 28 to 50 inches.

The Ap horizon has value of 2 or 3. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 2 to 6. It is mostly silt loam with thin strata ranging from fine sand to silt. Some pedons do not have stratification.

Cress Series

The Cress series consists of very deep, somewhat excessively drained soils on pitted outwash plains and end moraines. These soils are shallow to sandy outwash. They formed in loamy alluvium and in the underlying stratified sandy outwash. Permeability is moderate or moderately rapid in the loamy mantle and rapid or very rapid in the sandy outwash. Slope ranges from 6 to 25 percent.

Typical pedon of Cress sandy loam, in an area of Cress-Mahtomedi complex, 15 to 25 percent slopes, 400 feet south and 1,100 feet west of the northeast corner of sec. 29, T. 36 N., R. 10 W.

A—0 to 3 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; common fine and medium roots; about 2 percent gravel; strongly acid; clear smooth boundary.

Bw1—3 to 15 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common fine and medium roots; about 5 percent gravel; strongly acid; clear smooth boundary.

2Bw2—15 to 31 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; few fine roots; about 10 percent gravel; moderately acid; clear smooth boundary.

2Bw3—31 to 36 inches; dark brown (7.5YR 4/4) gravelly loamy sand; weak medium subangular blocky structure; loose; few fine roots; 20 percent gravel; moderately acid; clear smooth boundary.

2C—36 to 60 inches; reddish brown (5YR 4/4), stratified gravelly sand; single grain; loose; about 20 percent gravel (as an average); moderately acid.

The thickness of the solum ranges from 26 to 50 inches. The thickness of the loamy alluvium ranges from 10 to 24 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam or fine sandy loam. The 2Bw horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loamy sand, sand, or the gravelly analogs of these textures. The 2C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is stratified. The strata are mostly the gravelly or very

gravelly analogs of sand or coarse sand, but most pedons have strata of sand or coarse sand. The volume of gravel ranges from 15 to 45 percent in the 2C horizon, as a weighted average.

Crystal Lake Series

The Crystal Lake series consists of very deep, moderately well drained soils on glacial lake plains. These soils formed in silty lacustrine deposits. Permeability is moderate in the subsoil and moderately slow in the substratum. Slope ranges from 0 to 6 percent.

Typical pedon of Crystal Lake silt loam, 0 to 2 percent slopes, 2,200 feet north and 50 feet west of the southeast corner of sec. 29, T. 35 N., R. 14 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; common fine and medium roots; neutral; abrupt smooth boundary.

E—8 to 12 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; common fine and medium roots; slightly acid; clear smooth boundary.

B/E—12 to 20 inches; about 70 percent dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common distinct dark brown (7.5YR 4/2) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; moderately acid; clear wavy boundary.

Bt1—20 to 26 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark brown (7.5YR 4/2) clay films on faces of peds; few fine distinct strong brown (7.5YR 5/6) masses of iron accumulation; moderately acid; clear wavy boundary.

Bt2—26 to 34 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few distinct dark brown (7.5YR 4/2) clay films on faces of peds; few medium distinct strong brown (7.5YR 5/8) masses of iron accumulation; strongly acid; clear wavy boundary.

C—34 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; strongly acid.

The thickness of the solum ranges from 30 to 50 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 3 or 4. Some pedons have thin strata of fine sand, very fine sand, or loamy very fine sand in the lower part of the Bt horizon or in the C horizon, or both.

Dobie Series

The Dobie series consists of well drained soils on uplands. These soils are moderately deep to sandstone. They formed in loess and loamy residuum underlain by sandstone. Permeability is moderate in the subsoil and is slow to moderate in the sandstone. Slope ranges from 2 to 20 percent.

Typical pedon of Dobie silt loam, 2 to 6 percent slopes, 2,440 feet south and 1,440 feet west of the northeast corner of sec. 15, T. 32 N., R. 13 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; moderate medium and fine granular structure; friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

B/E—8 to 16 inches; about 80 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common faint dark brown (10YR 3/3) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bt1—16 to 26 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; many distinct dark brown (7.5YR 3/4) clay films on faces of peds; about 3 percent sandstone channers; moderately acid; clear smooth boundary.

Bt2—26 to 31 inches; olive brown (2.5Y 4/4) loam; moderate medium subangular blocky structure; friable; few fine roots; few prominent dark brown (7.5YR 3/4) clay films on faces of peds; about 3 percent sandstone channers; slightly acid; clear smooth boundary.

2Bt3—31 to 37 inches; olive (5YR 4/4) very fine sandy loam; moderate medium subangular blocky structure; very friable; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; about 3

percent sandstone channers; slightly acid; clear wavy boundary.
2Cr1—37 to 42 inches; strong brown (7.5YR 5/6 and 5/8) glauconitic sandstone; clear wavy boundary.
2Cr2—42 to 50 inches; strata of dark brown (7.5YR 4/4) and grayish green (5G 4/2) glauconitic sandstone; clear wavy boundary.
2Cr3—50 to 60 inches; grayish green (5G 4/2) glauconitic sandstone.

The thickness of the solum, the depth to sandstone, and the thickness of the loess mantle range from 20 to 40 inches. The volume of sandstone channers ranges from 0 to 5 percent in the loess and from 0 to 20 percent in the 2Bt horizon.

The Ap horizon has value of 3 or 4 and chroma of 2 to 4. Some pedons have an E horizon, which has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. The 2Bt horizon has hue of 7.5YR, 10YR, 2.5Y, 5Y, or 5G, value of 3 to 6, and chroma of 2 to 6. It is loam, very fine sandy loam, fine sandy loam, sandy loam, or the channery analogs of these textures.

Doritty Series

The Doritty series consists of very deep, moderately well drained, moderately permeable soils on valley sides. These soils formed in silty colluvium. Slope ranges from 2 to 6 percent.

Typical pedon of Doritty silt loam, 2 to 6 percent slopes, 2,240 feet north and 2,490 feet west of the southeast corner of sec. 13, T. 33 N., R. 12 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine and medium roots; neutral; abrupt smooth boundary.
E—9 to 12 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; neutral; clear smooth boundary.
B/E—12 to 18 inches; about 60 percent dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few faint dark brown (7.5YR 3/4) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; strongly acid; clear smooth boundary.
Bt1—18 to 26 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common faint dark brown (7.5YR 3/4) clay films on faces of peds; moderately acid; clear smooth boundary.
Bt2—26 to 32 inches; dark brown (7.5YR 4/4) silt loam; moderate coarse subangular blocky structure; friable; few fine roots; many distinct dark brown (7.5YR 3/2) clay films on faces of peds; strongly acid; clear smooth boundary.
Bt3—32 to 38 inches; dark brown (7.5YR 4/4) silt loam; moderate coarse subangular blocky structure; friable; few fine roots; common distinct dark brown (7.5YR 3/2) clay films on faces of peds; few medium distinct strong brown (7.5YR 5/6) masses of iron accumulation; very strongly acid; clear wavy boundary.
C—38 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; few fine and medium prominent strong brown (7.5YR 4/6) masses of iron accumulation and few medium faint pale brown (10YR 6/3) iron depletions; very strongly acid.

The thickness of the solum ranges from 30 to 50 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The C horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6.

Fordum Series

The Fordum series consists of very deep, poorly drained soils on flood plains. These soils formed in silty and loamy alluvium underlain by sandy alluvium. Permeability is moderate or moderately rapid in the silty and loamy alluvium and rapid or very rapid in the underlying sandy alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Fordum silt loam, 0 to 2 percent slopes, 300 feet north and 1,800 feet east of the southwest corner of sec. 1, T. 36 N., R. 10 W.

A—0 to 8 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate

coarse subangular blocky structure; friable; common fine roots; strongly acid; clear smooth boundary.

Cg1—8 to 21 inches; dark grayish brown (10YR 4/2) silt loam; a few thin strata of very fine sand; moderate coarse subangular blocky structure; friable; common fine roots; many medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; about 3 percent gravel; moderately acid; abrupt smooth boundary.

Cg2—21 to 27 inches; dark brown (7.5YR 4/2) sandy loam; massive; friable; many medium distinct strong brown (7.5YR 5/6) masses of iron accumulation; moderately acid; clear smooth boundary.

Cg3—27 to 60 inches; dark brown (7.5YR 4/4) gravelly sand; single grain; loose; about 30 percent gravel; strongly acid.

The thickness of the loamy alluvium and the depth to sandy alluvium range from 24 to 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. The upper loamy part of the C horizon has hue of 7.5YR, 10YR, or 2.5Y or is neutral in hue. It has value of 2 to 6 and chroma of 0 to 2. It is typically silt loam, loam, sandy loam, or fine sandy loam, but in some pedons it has thin strata of very fine sand or fine sand. The sandy lower part of the C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 4. It is sand, coarse sand, loamy sand, loamy coarse sand, or the gravelly analogs of these textures. In some pedons thin strata of loam or silt loam are in the sandy part of the C horizon.

Freeon Series

The Freeon series consists of moderately well drained soils on moraines. These soils are deep or very deep to dense till. They formed in loess or other silty deposits and in the underlying dense loamy glacial till. Permeability is moderate in the silty mantle, slow or moderately slow in the lower part of the subsoil, and very slow in the substratum. Slope ranges from 2 to 12 percent.

Typical pedon of Freeon silt loam, 2 to 6 percent slopes, 1,100 feet north and 200 feet west of the southeast corner of sec. 16, T. 33 N., R. 12 W.

Ap—0 to 7 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; about 2 percent gravel; moderately acid; abrupt smooth boundary.

E/B—7 to 19 inches; about 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure; friable; tonguing into or surrounding remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; common fine and very fine roots; many very fine and few medium tubular pores; common coarse prominent strong brown (7.5YR 4/6) masses of iron accumulation; about 5 percent gravel and 1 percent cobbles; slightly acid; clear smooth boundary.

2B/E—19 to 39 inches; about 70 percent dark brown (7.5YR 3/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; common faint dark brown (7.5YR 3/4) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; weak thick platy structure; friable; few fine roots; many fine tubular pores; common coarse distinct and prominent strong brown (7.5YR 5/8) masses of iron accumulation; about 12 percent gravel and 1 percent cobbles; strongly acid; clear smooth boundary.

2Bt1—39 to 53 inches; dark reddish brown (5YR 3/4) sandy loam; moderate fine subangular blocky structure; friable; tendency to part along horizontal cleavage planes inherited from the parent material; few fine roots; common fine tubular pores; common fine and medium vesicular pores; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; common prominent brown (10YR 5/3) coatings on vertical faces of some peds; few coarse prominent strong brown (7.5YR 5/8) masses of iron accumulation; about 5 percent gravel and 1 percent cobbles; strongly acid; clear smooth boundary.

2Bt2—53 to 69 inches; dark reddish brown (5YR 3/4) sandy loam; moderate fine subangular blocky structure; friable; tendency to part along horizontal cleavage planes inherited from the parent material; many fine tubular pores; few medium vesicular pores; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; few medium prominent strong brown (7.5YR 5/8) masses of iron accumulation; about 5 percent gravel and 1 percent cobbles; moderately acid; clear wavy boundary.

2Bt3—69 to 85 inches; dark reddish brown (5YR 3/4) sandy loam; moderate fine subangular blocky structure; friable; tendency to part along horizontal cleavage planes inherited from the parent material; many fine tubular pores; few fine vesicular pores; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; about 5

percent gravel and 1 percent cobbles; moderately acid; clear wavy boundary.

2Cd—85 to 99 inches; reddish brown (5YR 4/4) sandy loam; massive; firm; tendency to part along horizontal cleavage planes; about 5 percent gravel and 1 percent cobbles; moderately acid.

The thickness of the solum and the depth to the dense till (Cd horizon) range from 40 to 90 inches. The thickness of the silty mantle ranges from 12 to 36 inches.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. The E horizon has value of 4 or 5 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. Pedons with a thinner mantle of loess typically have a 2B/E horizon. The 2E part of this horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 2 or 3. It is sandy loam, loam, or the gravelly analogs of these textures. The 2Bt part has colors and textures similar to those of the 2Bt horizon. The 2Bt horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is sandy loam, loam, or the gravelly analogs of these textures. The content of gravel ranges from 5 to 35 percent. The 2Cd horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is sandy loam or gravelly sandy loam. The content of gravel ranges from 5 to 35 percent.

Friendship Series

The Friendship series consists of very deep, moderately well drained, rapidly permeable soils on outwash plains. These soils formed in sandy outwash. Slope ranges from 0 to 3 percent.

Typical pedon of Friendship loamy sand, 0 to 3 percent slopes, 1,540 feet north and 2,240 feet west of the southeast corner of sec. 17, T. 33 N., R. 11 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; common fine and medium roots; neutral; abrupt smooth boundary.

Bw1—9 to 16 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; few fine roots; slightly acid; clear smooth boundary.

Bw2—16 to 27 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; few fine roots; moderately acid; clear smooth boundary.

C1—27 to 35 inches; strong brown (7.5YR 4/6) sand; single grain; loose; slightly acid; clear smooth boundary.

C2—35 to 60 inches; strong brown (7.5YR 4/6) sand; single grain; loose; many medium and coarse prominent yellowish brown (10YR 5/8) masses of iron accumulation; strongly acid.

The thickness of the solum ranges from 20 to 50 inches.

The A or Ap horizon has value of 2 or 3 and chroma of 1 to 3. The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6.

Greenwood Series

The Greenwood series consists of very deep, very poorly drained soils in depressions on ground moraines and outwash plains. These soils formed in more than 51 inches of herbaceous organic material. Permeability is moderate or moderately rapid. Slope is 0 to 1 percent.

Typical pedon of Greenwood peat, 0 to 1 percent slopes, 1,940 feet north and 2,440 feet east of the southwest corner of sec. 34, T. 33 N., R. 10 W.

Oi—0 to 12 inches; yellowish brown (10YR 5/4) peat; about 95 percent fiber, 90 percent rubbed; massive; very strongly acid (pH 4.9 in water); abrupt wavy boundary.

Oe1—12 to 20 inches; mucky peat, dark yellowish brown (10YR 3/4) broken face, pressed, and rubbed; about 70 percent fiber, 30 percent rubbed; weak thick platy structure; nonsticky; herbaceous fiber; very strongly acid (pH 4.8 in water); clear smooth boundary.

Oe2—20 to 30 inches; mucky peat, dark brown (7.5YR 3/2) broken face, pressed, and rubbed; about 70 percent fiber, 30 percent rubbed; weak coarse subangular blocky structure; nonsticky; herbaceous fiber; very strongly acid (pH 4.8 in water); clear smooth boundary.

Oe3—30 to 38 inches; mucky peat, dark brown (7.5YR 3/2) broken face, pressed, and rubbed; about 50 percent fiber, 20 percent rubbed; weak coarse subangular blocky structure; nonsticky; herbaceous fiber; very strongly acid (pH 4.8 in water); clear smooth boundary.

Oe4—38 to 52 inches; mucky peat, dark brown (7.5YR 3/2) broken face, pressed, and rubbed; about 60 percent fiber, 20 percent rubbed; weak coarse subangular blocky structure; nonsticky; extremely acid (pH 4.0 in water); clear smooth boundary.

Oa—52 to 60 inches; muck, dark reddish brown (5YR 3/2) broken face, pressed, and rubbed; about 60 percent fiber, 10 percent rubbed; weak coarse subangular blocky structure; nonsticky; herbaceous fiber; very strongly acid (pH 4.9 in water).

The organic material is more than 51 inches thick. It is dominantly mucky peat, but some pedons have thin layers of peat and muck with a combined thickness of less than 10 inches. Some pedons have a surface cover of sphagnum moss less than 8 inches thick.

The surface and subsurface tiers have hue of 5YR, 7.5YR, or 10YR, value of 2 to 6, and chroma of 1 to 4.

Haugen Series

The Haugen series consists of moderately well drained soils on moraines. These soils are deep or very deep to dense glacial till. They formed in mostly loamy glacial mudflow sediment and in dense loamy glacial till. Permeability is moderate in the upper part of the subsoil, moderate or moderately slow in the lower part of the subsoil, and very slow in the substratum. Slope ranges from 2 to 15 percent.

Typical pedon of Haugen sandy loam, 6 to 12 percent slopes, 2,240 feet north and 1,390 feet east of the southwest corner of sec. 9, T. 36 N., R. 12 W.

A—0 to 4 inches; very dark brown (10YR 2/2) sandy loam, grayish brown (10YR 5/2) dry; moderate medium and fine granular structure; friable; many fine, medium, and coarse roots; a few clean sand grains; 6 percent gravel; strongly acid; clear smooth boundary.

Bw1—4 to 15 inches; dark yellowish brown (10YR 3/4) sandy loam; moderate fine subangular blocky structure; friable; many fine and common medium and coarse roots; many fine tubular pores; 13 percent gravel; strongly acid; clear smooth boundary.

Bw2—15 to 23 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; moderate medium and fine subangular blocky structure; friable; common fine and few medium roots; many fine tubular pores; 18 percent gravel, about 1 percent cobbles; strongly acid; abrupt wavy boundary.

E/B—23 to 35 inches; about 80 percent reddish brown (5YR 4/3) gravelly sandy loam (E), pink (5YR 7/3) dry; weak thin platy structure; friable; tonguing into or surrounding remnants of dark reddish brown (5YR 3/4) sandy loam (Bt); weak fine subangular blocky structure; friable; common faint reddish brown (5YR 4/4) clay films on faces of peds; few fine roots; many fine and medium tubular pores; 16 percent gravel, about 1 percent cobbles; moderately acid; clear wavy boundary.

B/E—35 to 49 inches; about 65 percent dark reddish brown (5YR 3/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; common faint reddish brown (5YR 4/4) clay films on faces of peds; penetrated by tongues of reddish brown (5YR 4/3) sandy loam (E), pink (5YR 7/3) dry; moderate thin platy structure; friable; few fine roots; many fine tubular pores; few fine distinct yellowish red (5YR 4/6) masses of iron accumulation; 12 percent gravel, about 1 percent cobbles; moderately acid; clear wavy boundary.

Bt1—49 to 60 inches; reddish brown (5YR 4/4) gravelly loamy sand; moderate medium and fine subangular blocky structure; friable; few fine roots; few fine tubular pores; common faint reddish brown (5YR 4/4) clay bridges between mineral grains; few fine distinct yellowish red (5YR 5/8) masses of iron accumulation; 25 percent gravel, about 2 percent cobbles; moderately acid; clear wavy boundary.

Bt2—60 to 79 inches; dark reddish brown (5YR 3/4) gravelly sandy loam; weak fine subangular blocky structure; firm; tendency to part along horizontal cleavage planes inherited from the parent material; few fine roots; few fine tubular pores; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; few fine distinct yellowish red (5YR 5/8) masses of iron accumulation; two silty strata about 0.5 inch thick; 19 percent gravel, about 1 percent cobbles; slightly acid; clear wavy boundary.

Cd—79 to 88 inches; reddish brown (5YR 4/4) gravelly sandy loam; massive; firm; 17 percent gravel, about 2 percent cobbles; slightly acid.

The thickness of the solum ranges from 40 to more than 80 inches. The volume of gravel ranges from 3 to 35 percent throughout the profile. The volume of cobbles ranges from 0 to 10 percent throughout the profile.

The A or Ap horizon has value of 2 to 4 and chroma of 1 to 3. The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 4 to 6. It is loam, sandy loam, or the gravelly analogs of these textures. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 2 or 3. It is sandy loam, fine sandy loam, loamy sand, or the gravelly analogs of these textures. The Bt part of the E/B or B/E horizon has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, fine sandy loam, loamy sand,

or the gravelly analogs of these textures. The Cd horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, fine sandy loam, loamy sand, or the gravelly analogs of these textures.

Hayriver Series

The Hayriver series consists of well drained soils on uplands. These soils are moderately deep to sandstone. They formed in loamy residuum underlain by glauconitic sandstone or by sandy residuum and glauconitic sandstone. Permeability is moderate or moderately rapid in the subsoil and slow to moderate in the sandstone. Slope ranges from 2 to 50 percent.

Typical pedon of Hayriver fine sandy loam, 6 to 12 percent slopes, eroded, 2,340 feet north and 1,240 feet west of the southeast corner of sec. 35, T. 32 N., R. 12 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

E—8 to 13 inches; brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry; moderate medium and thin platy structure parting to moderate very fine subangular blocky; friable; few fine roots; about 2 percent sandstone channers; slightly acid; clear smooth boundary.

Bt1—13 to 24 inches; dark yellowish brown (10YR 4/4) fine sandy loam; moderate fine and medium subangular blocky structure; friable; few fine roots; common distinct dark yellowish brown (10YR 4/6) clay films on faces of peds; about 2 percent sandstone channers; moderately acid; clear smooth boundary.

Bt2—24 to 30 inches; dark yellowish brown (10YR 4/4) fine sandy loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark yellowish brown (10YR 4/6) clay films on faces of peds; about 2 percent sandstone channers; strongly acid; clear smooth boundary.

Cr—30 to 60 inches; yellowish brown (10YR 5/4), fine grained glauconitic sandstone with common black (5Y 2.5/2) grains of glauconite.

The thickness of the solum and the depth to weakly cemented sandstone range from 20 to 40 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon, which has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Ap or A horizon is loam or fine sandy loam. The Bt horizon has hue of 7.5YR, 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 2 to 8. The C horizon, if it occurs, has hue of 10YR, 2.5Y, 5Y, 5GY, or 5G, value of 4 to 7, and chroma of 2 to 6. It is loamy sand, sand, or fine sandy loam. The Cr horizon has colors similar to those of the C horizon.

Magnor Series

The Magnor series consists of somewhat poorly drained soils on moraines. These soils are deep to dense till. They formed in loess or other silty deposits and in the underlying dense sandy loam or loam glacial till. Permeability is moderate in the silty mantle, moderately slow or slow in the loamy lower part of the subsoil, and very slow in the substratum. Slope ranges from 0 to 4 percent.

Typical pedon of Magnor silt loam, 0 to 4 percent slopes, 400 feet south and 900 feet east of the northwest corner of sec. 23, T. 34 N., R. 10 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; few fine roots; moderately acid; abrupt smooth boundary.

E—8 to 10 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; strongly acid; clear smooth boundary.

E/B—10 to 18 inches; about 70 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common faint dark brown (10YR 4/3) clay films on faces of peds; few fine roots; common medium faint and distinct light brownish gray (10YR 6/2) iron depletions and common medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; strongly acid; clear smooth boundary.

B/E—18 to 24 inches; about 70 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common faint dark brown (10YR 4/3) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; common medium distinct yellowish brown (10YR 5/6) masses of iron accumulation and common medium distinct and faint light brownish gray (10YR 6/2) iron depletions; about 3 percent gravel in the lower part; strongly acid; clear smooth boundary.

2Bt1—24 to 32 inches; reddish brown (5YR 4/4) sandy loam; moderate fine and medium subangular blocky structure; friable; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; about 13 percent gravel; strongly acid; clear smooth boundary.

2Bt2—32 to 40 inches; reddish brown (5YR 4/4) sandy loam; moderate medium and coarse subangular blocky structure; friable; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; about 7 percent gravel and 2 percent cobbles; moderately acid; clear smooth boundary.

2Bt3—40 to 50 inches; reddish brown (5YR 4/4) sandy loam; moderate coarse subangular blocky structure; friable; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; about 7 percent gravel and 2 percent cobbles; moderately acid; clear smooth boundary.

2Cd—50 to 60 inches; reddish brown (5YR 4/4) sandy loam; massive; firm; about 10 percent gravel and 2 percent cobbles; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The thickness of the loess ranges from 12 to 36 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the 2Bt horizon. The 2Bt horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is loam or sandy loam. The 2Cd horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is sandy loam or loam or the gravelly analogs of these textures. The content of gravel and cobbles in the 2Bt and 2Cd horizons ranges from 5 to 35 percent.

Mahtomedi Series

The Mahtomedi series consists of very deep, excessively drained soils on pitted outwash plains and end moraines. These soils formed in stratified sandy outwash. Permeability is rapid or very rapid. Slope ranges from 6 to 25 percent.

Typical pedon of Mahtomedi loamy sand, in an area of Cress-Mahtomedi complex, 15 to 25 percent slopes, 2,240 feet north and 2,240 feet east of the southwest corner of sec. 5, T. 36 N., R. 14 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; moderate fine granular structure; very friable; many fine roots; many clean sand grains throughout; strongly acid; abrupt wavy boundary.

Bw1—4 to 14 inches; dark brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; common fine roots; about 4 percent gravel; moderately acid; clear smooth boundary.

Bw2—14 to 26 inches; dark brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; few fine roots; about 12 percent gravel; moderately acid; clear smooth boundary

C—26 to 60 inches; reddish brown (5YR 4/4), stratified gravelly sand and sand; single grain; loose; about 20 percent gravel; moderately acid.

The thickness of the solum ranges from 20 to 40 inches. The volume of gravel ranges from 0 to 35 percent in the upper part of the solum and from 15 to 35 percent in the lower part of the solum and in the C horizon.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The Bw horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5, and chroma of 4 to 6. It is typically sand, coarse sand, or the gravelly analogs of these textures, but in some pedons it is loamy sand or gravelly loamy sand in the upper part. The C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 or 4. It is gravelly sand or gravelly coarse sand.

Markey Series

The Markey series consists of very deep, very poorly drained soils in depressions and drainageways on outwash plains. These soils formed in decomposed organic material underlain by sandy alluvium. Permeability is moderately slow to moderately rapid in the organic layers and rapid in the substratum. Slope is 0 to 1 percent.

Typical pedon of Markey muck, 0 to 1 percent slopes, 1,100 feet south and 1,000 feet west of the northeast corner of sec. 1, T. 32 N., R. 10 W.

Oa1—0 to 10 inches; muck, black (N 2/0) broken face, rubbed, and pressed; about 10 percent fiber, 2 percent rubbed; weak thick platy structure; nonsticky; herbaceous fiber; slightly acid (pH 6.5 in water); clear wavy boundary.

Oa2—10 to 22 inches; muck, black (5YR 2/1) broken

face, rubbed, and pressed; about 20 percent fiber, 5 percent rubbed; weak coarse subangular blocky structure; nonsticky; herbaceous fiber; about 5 percent woody fragments; slightly acid (pH 6.5 in water); clear wavy boundary.

Oa3—22 to 38 inches; muck, black (N 2/0) broken face, rubbed, and pressed; about 10 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; nonsticky; herbaceous fiber; slightly acid (pH 6.5 in water); clear wavy boundary.

Oa4—38 to 44 inches; muck, black (5YR 2/1) broken face, rubbed, and pressed; about 20 percent fiber, 2 percent rubbed; weak coarse subangular blocky structure; nonsticky; herbaceous fiber; slightly acid (pH 6.5 in water); abrupt smooth boundary.

Cg—44 to 60 inches; olive gray (5Y 4/2) sand; single grain; loose; moderately acid.

The organic material ranges from 16 to 51 inches in thickness. It is dominantly muck, but some pedons have thin layers of mucky peat or peat.

The organic material has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. The Cg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 0 to 2. It is sand or loamy sand.

Meehan Series

The Meehan series consists of very deep, somewhat poorly drained, rapidly permeable soils in shallow depressions on outwash plains. These soils formed in sandy outwash. Slope ranges from 0 to 2 percent.

Typical pedon of Meehan loamy sand, 0 to 2 percent slopes, 1,100 feet south and 1,200 feet east of the northwest corner of sec. 24, T. 32 N., R. 10 W.

A—0 to 5 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak moderate granular structure; very friable; common fine and medium roots; very strongly acid; abrupt smooth boundary.

E—5 to 8 inches; brown (10YR 5/3) loamy sand, very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; common fine and medium roots; very strongly acid; clear smooth boundary.

Bw1—8 to 16 inches; dark brown (10YR 4/3) sand; weak medium subangular blocky structure; very friable; few fine roots; many medium faint grayish brown (10YR 5/2) iron depletions and few medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

Bw2—16 to 21 inches; dark brown (10YR 4/3) sand; weak coarse subangular blocky structure; very friable; few fine roots; few medium faint grayish brown (10YR 5/2) iron depletions and common medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

Bw3—21 to 28 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; many coarse distinct yellowish brown (10YR 5/6) masses of iron accumulation and few fine distinct grayish brown (10YR 5/2) iron depletions; strongly acid; clear smooth boundary.

C—28 to 60 inches; dark brown (10YR 4/3) sand; single grain; loose; few medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; moderately acid.

The thickness of the solum ranges from 24 to 48 inches.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 8. The C horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 4.

Menahga Series

The Menahga series consists of very deep, excessively drained, rapidly permeable soils on outwash plains. These soils formed in sandy outwash. Slope ranges from 0 to 25 percent.

Typical pedon of Menahga loamy sand, 0 to 2 percent slopes, 200 feet north and 650 feet west of the southeast corner of sec. 36, T. 33 N., R. 10 W.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; few fine roots; about 3 percent gravel; neutral; abrupt smooth boundary.

Bw1—12 to 14 inches; dark yellowish brown (10YR 4/4) sand; weak medium subangular blocky structure; very friable; few fine roots; about 3 percent gravel; slightly acid; clear smooth boundary.

Bw2—14 to 26 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; few fine roots; about 3 percent gravel; slightly acid; clear smooth boundary.

Bw3—26 to 32 inches; strong brown (7.5YR 5/6) sand; weak medium subangular blocky structure; very friable; about 3 percent gravel; moderately acid; clear smooth boundary.

C—32 to 60 inches; yellowish brown (10YR 5/6) sand; single grain; loose; about 3 percent gravel; moderately acid.

The thickness of the solum ranges from 20 to 46 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6.

Moppet Series

The Moppet series consists of very deep, moderately well drained soils on flood plains. These soils are moderately deep to sandy outwash. They formed mostly in loamy alluvium underlain by sandy alluvium. Permeability is moderate or moderately rapid in the loamy alluvium and rapid in the sandy substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Moppet fine sandy loam, 0 to 2 percent slopes, 2,200 feet south and 1,850 feet east of the northwest corner of sec. 32, T. 35 N., R. 13 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many very fine and fine roots; extremely acid; clear smooth boundary.

E—4 to 10 inches; brown (10YR 4/3) fine sandy loam with thin strata of very fine sandy loam and silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; very friable; breaks to weak thin plates along depositional strata; common very fine and fine roots; extremely acid; clear smooth boundary.

Bw1—10 to 19 inches; dark yellowish brown (10YR 4/4) fine sandy loam with a few thin strata of fine sand; weak medium subangular blocky structure; very friable; breaks to weak thin plates along depositional strata; few very fine and fine roots; very strongly acid; clear smooth boundary.

Bw2—19 to 29 inches; dark yellowish brown (10YR 4/4) fine sandy loam with common thin strata of fine and very fine sand; weak coarse subangular blocky structure; friable; breaks to moderate medium plates along depositional strata; few very fine and fine roots; few fine prominent strong brown (7.5YR 4/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

Bw3—29 to 39 inches; dark yellowish brown (10YR 4/4) fine sandy loam with few thin strata of fine sand; weak coarse subangular blocky structure; friable; breaks to moderate medium plates along depositional strata; few very fine and fine roots; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

2C—39 to 60 inches; dark yellowish brown (10YR 4/6) gravelly sand; single grain; loose; few medium faint yellowish brown (10YR 5/6) masses of iron accumulation; about 20 percent gravel; strongly acid.

The thickness of the solum, the thickness of the loamy mantle, and the depth to sandy alluvium range from 24 to 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 1 to 3. The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is fine sandy loam, sandy loam, loam, or silt loam and typically has thin strata of coarser or finer texture. The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 4 to 6. It is typically fine sandy loam, sandy loam, or loam but is silt loam in the upper part in some pedons. It typically has thin strata of coarser or finer texture. Some pedons have a 2BC horizon. This horizon has colors and textures similar to those of the 2C horizon. The 2C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sand, fine sand, loamy sand, loamy fine sand, or the gravelly analogs of these textures. It has thin strata of finer texture in some pedons. The content of gravel ranges from 0 to 35 percent in the 2BC and 2C horizons.

Newood Series

The Newood series consists of moderately well drained soils on moraines. These soils are deep or very deep to dense glacial till. They formed in mostly loamy glacial till. Permeability is moderate in the upper part of the subsoil, slow in the lower part of the subsoil, and very slow in the substratum. Slope ranges from 2 to 15 percent.

Typical pedon of Newood sandy loam, 2 to 6 percent slopes, 1,750 feet south and 1,750 feet west of the northeast corner of sec. 19, T. 36 N., R. 9 W., in Rusk County, Wisconsin:

Oa—0 to 1 inch; black (10YR 2/1) muck (sapric material occurring as a mat of partially decomposed forest litter); about 30 percent fiber, 10 percent rubbed; weak medium granular structure; very friable; very strongly acid; abrupt smooth boundary.

E—1 to 3 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; friable; many fine and

medium roots; 3 percent gravel; strongly acid; abrupt wavy boundary.

Bs—3 to 11 inches; dark brown (7.5YR 3/4) loamy sand; weak medium subangular blocky structure; friable; many fine and medium roots; 7 percent gravel; very strongly acid; clear wavy boundary.

Bw—11 to 21 inches; brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; 5 percent gravel; strongly acid; clear wavy boundary.

E/B—21 to 28 inches; 60 percent brown (7.5YR 4/3) sandy loam (E), pink (7.5YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark brown (7.5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds; common fine and medium roots; few fine distinct strong brown (7.5YR 5/6) masses of iron accumulation; 1 percent gravel; strongly acid; clear wavy boundary.

B/E—28 to 40 inches; 70 percent reddish brown (5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds; penetrated by tongues of brown (7.5YR 5/3) sandy loam (E), pink (7.5YR 7/3) dry; weak medium platy structure; friable; common fine and medium roots; common medium distinct and prominent yellowish red (5YR 5/6) masses of iron accumulation; 9 percent gravel; strongly acid; clear wavy boundary.

Bt1—40 to 53 inches; yellowish red (5YR 4/6) loamy sand; moderate medium subangular blocky structure; friable; few fine and medium roots; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds; common medium faint yellowish red (5YR 5/6) masses of iron accumulation; 8 percent gravel and 1 percent cobbles; strongly acid; clear wavy boundary.

Bt2—53 to 64 inches; yellowish red (5YR 4/6) loamy sand; moderate medium subangular blocky structure; friable; few fine roots; few distinct dark reddish brown (5YR 3/4) clay films on faces of peds; few medium faint yellowish red (5YR 5/6) masses of iron accumulation; 12 percent gravel and 1 percent cobbles; moderately acid; clear wavy boundary.

Cd—64 to 80 inches; yellowish red (5YR 4/6) sandy loam; massive; firm; 13 percent gravel and 1 percent cobbles; moderately acid.

The thickness of the solum and the depth to the Cd horizon are more than 40 inches. The volume of gravel ranges from 2 to 35 percent throughout the profile. The volume of cobbles ranges from about 0 to 10 percent throughout the profile.

The A horizon, if it occurs, has value of 2 or 3 and chroma of 1 or 2. The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is loam, loamy sand, sandy loam, or the gravelly analogs of these textures. The Bs horizon has value of 3 or 4 and chroma of 3 to 5. It is sandy loam, loam, or the gravelly analogs of these textures. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon. The Bt part has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is loamy sand, sandy loam, fine sandy loam, or the gravelly analogs of these textures. Some pedons do not have a Bt horizon. If it occurs, the Bt horizon has colors and textures similar to those of the Bt part of the E/B or B/E horizon. The Cd horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, fine sandy loam, or the gravelly analogs of these textures.

Newot Series

The Newot series consists of well drained soils on moraines. These soils are deep or very deep to dense glacial till. They formed in mostly loamy glacial till. Permeability is moderate in the upper part of the subsoil, slow in the lower part of the subsoil, and very slow in the substratum. Slope ranges from 15 to 35 percent.

Typical pedon of Newot sandy loam, 15 to 35 percent slopes, approximately 850 feet north and 900 feet west of the southeast corner of sec. 23, T. 36 N., R. 10 E.

Oe—0 to 2 inches; black (7.5YR 2.5/1 rubbed) mucky peat (hemic material occurring as a mat of partially decomposed forest litter); about 80 percent fiber, 20 percent rubbed; weak medium granular structure; very friable; very strongly acid; abrupt smooth boundary.

E—2 to 4 inches; brown (7.5YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; weak thick platy structure parting to moderate fine subangular blocky; friable; many very fine and fine and few medium and coarse roots; few fine tubular pores; about 3 percent gravel; extremely acid; clear wavy boundary.

Bs1—4 to 10 inches; dark brown (7.5YR 4/4) sandy loam; moderate fine subangular blocky structure; friable; many very fine and fine and few medium and coarse roots; few fine tubular pores; about 5 percent gravel and 5 percent cobbles; strongly acid; gradual wavy boundary.

Bs2—10 to 21 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few very fine to coarse roots; few fine tubular pores; about 7 percent gravel and 7 percent cobbles; strongly acid; clear wavy boundary.

E/B—21 to 41 inches; 60 percent reddish brown (5YR 4/3) loamy sand (E´), pink (5YR 7/3) dry; moderate medium platy structure; very friable; tonguing into and surrounding remnants of dark reddish brown (2.5YR 3/4) sandy loam (Bt); moderate fine subangular blocky structure; friable; few faint dark reddish brown (2.5YR 2.5/4) clay films on faces of peds; few very fine to coarse roots; few fine tubular and interstitial pores; about 6 percent gravel and 8 percent cobbles; strongly acid; gradual wavy boundary.

B/E—41 to 62 inches; 70 percent dark reddish brown (2.5YR 3/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few faint dark reddish brown (2.5YR 2.5/4) clay films on faces of peds; penetrated by tongues of reddish brown (5YR 4/3) loamy sand (E´), pink (5YR 7/3) dry; weak thick platy structure; very friable; few fine to coarse roots; few fine tubular and interstitial pores; about 6 percent gravel and 8 percent cobbles; moderately acid; gradual wavy boundary.

Cd—62 to 80 inches; dark reddish brown (2.5YR 3/4) sandy loam; massive; firm; about 5 percent gravel and 8 percent cobbles; moderately acid.

The thickness of the solum and the depth to the Cd horizon are more than 40 inches. The volume of gravel ranges from 2 to 35 percent throughout the profile. The volume of cobbles ranges from about 0 to 10 percent throughout the profile.

The A horizon, if it occurs, has value of 2 or 3 and chroma of 1 or 2. The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is loam, loamy sand, sandy loam, or the gravelly analogs of these textures. The Bs horizon has value of 3 or 4 and chroma of 3 to 5. It is sandy loam, loam, or the gravelly analogs of these textures. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon. The Bt part has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is typically sandy loam, fine sandy loam, or the gravelly analogs of these textures, but in some pedons it has subhorizons of loamy sand or gravelly loamy sand. Some pedons have a Bt horizon, which has colors and textures similar to those of the Bt part of the E/B or B/E horizon. The Cd horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, fine sandy loam, loamy sand, or the gravelly analogs of these textures.

Newson Series

The Newson series consists of very deep, poorly drained, rapidly permeable soils in drainageways and depressions on outwash plains. These soils formed in sandy outwash. Slope ranges from 0 to 2 percent.

Typical pedon of Newson loamy sand, 0 to 2 percent slopes, 2,100 feet north and 300 feet east of the southwest corner of sec. 13, T. 32 N., R. 12 W.

A—0 to 8 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; very friable; many fine and medium roots; moderately acid; abrupt smooth boundary.

Bg1—8 to 12 inches; dark grayish brown (10YR 4/2) sand; weak medium subangular blocky structure; very friable; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; strongly acid; clear smooth boundary.

Bg2—12 to 21 inches; grayish brown (2.5Y 5/2) sand; weak medium subangular blocky structure; very friable; few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation; strongly acid; clear smooth boundary.

Bg3—21 to 28 inches; light brownish gray (2.5YR 6/2) sand; weak coarse subangular blocky structure; very friable; few fine roots; many coarse prominent yellowish brown (10YR 5/6) and common medium prominent strong brown (7.5YR 5/8) masses of iron accumulation; strongly acid; gradual wavy boundary.

Cg—28 to 60 inches; light brownish gray (2.5YR 6/2) sand; common medium prominent yellowish brown (10YR 5/6) masses of iron accumulation; single grain; loose; moderately acid.

The thickness of the solum ranges from 20 to 40 inches.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The Bg horizon and the BCg horizon, if it occurs, have hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The Cg horizon has hue of 7.5YR, 10YR, or 2.5YR, value of 4 to 6, and chroma of 1 to 6.

Oesterle Series

The Oesterle series consists of very deep, somewhat poorly drained soils on outwash plains and stream terraces. These soils are moderately deep to sandy outwash. They formed in loamy alluvium and in

the underlying sandy outwash. Permeability is moderate or moderately rapid in the loamy alluvium and rapid or very rapid in the sandy outwash. Slope ranges from 0 to 2 percent.

Typical pedon of Oesterle sandy loam, 0 to 2 percent slopes, 1,800 feet south and 400 feet east of the northwest corner of sec. 15, T. 33 N., R. 10 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine and medium roots; moderately acid; abrupt smooth boundary.

E—8 to 11 inches; brown (10YR 5/3) sandy loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; few fine prominent strong brown (7.5YR 5/8) masses of iron accumulation; moderately acid; clear smooth boundary.

B/E—11 to 17 inches; about 60 percent dark brown (7.5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few distinct dark brown (7.5YR 4/2) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; common medium distinct and prominent strong brown (7.5YR 5/8) masses of iron accumulation and common medium prominent and faint grayish brown (10YR 5/2) iron depletions; strongly acid; clear smooth boundary.

Bt1—17 to 25 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; few distinct dark brown (7.5YR 4/2) clay films on faces of peds; many medium prominent grayish brown (10YR 5/2) iron depletions and common medium distinct strong brown (7.5YR 5/8) masses of iron accumulation; strongly acid; clear wavy boundary.

2Bt2—25 to 31 inches; dark brown (7.5YR 4/4) loamy sand; weak coarse subangular blocky structure; very friable; few fine roots; common distinct dark brown (7.5YR 4/2) clay bridges between sand grains; common medium distinct strong brown (7.5YR 5/8) masses of iron accumulation and common medium prominent grayish brown (10YR 5/2) iron depletions; about 10 percent gravel; strongly acid; abrupt smooth boundary.

2C—31 to 60 inches; yellowish brown (10YR 5/6), stratified sand and gravelly sand; single grain; loose; about 10 percent gravel (as an average); moderately acid.

The thickness of the loamy mantle and the depth to sandy outwash range from 20 to 40 inches.

The Ap horizon has value and chroma of 2 or 3. Some pedons have an A horizon, which has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loam or sandy loam. The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 2 to 6. It is loamy sand or gravelly loamy sand. The content of gravel in the 2Bt and 2C horizons averages from 5 to 35 percent. The 2C horizon has colors similar to those of the 2Bt horizon. The 2C horizon is stratified with sand, coarse sand, or the gravelly or very gravelly analogs of these textures.

Otterholt Series

The Otterholt series consists of very deep, well drained soils on ground moraines. These soils formed in loess and loamy glacial till. Permeability is moderate in the silty mantle and moderate or moderately slow in the till. Slope ranges from 6 to 20 percent.

Typical pedon of Otterholt silt loam, 6 to 12 percent slopes, eroded, 2,000 feet north and 100 feet west of the center of sec. 34, T. 32 N., R. 14 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and very fine subangular blocky structure; friable; common fine and medium roots; neutral; abrupt smooth boundary.

E/B—9 to 17 inches; about 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few faint dark brown (7.5YR 3/4) clay films on faces of peds; few fine and medium roots; moderately acid; clear smooth boundary.

B/E—17 to 26 inches; about 70 percent dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common faint dark brown (7.5YR 3/4) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; strongly acid; clear smooth boundary.

Bt1—26 to 35 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common faint dark

brown (7.5YR 3/4) and few distinct dark brown (7.5YR 3/2) clay films on faces of peds; common distinct brown (10YR 5/3) coatings of clean silt grains on vertical faces of some peds; strongly acid; clear smooth boundary.

Bt2—35 to 41 inches; dark brown (7.5YR 4/4) silt loam; moderate coarse subangular blocky structure; friable; few fine roots; common faint dark brown (7.5YR 3/4) clay films on faces of peds and in pores; strongly acid; gradual wavy boundary.

2Bt3—41 to 45 inches; dark reddish brown (5YR 3/4) loam; weak medium subangular blocky structure; friable; few fine roots; few faint dark reddish brown (5YR 3/3) clay films on faces of peds; about 5 percent gravel; strongly acid; clear smooth boundary.

2C—45 to 60 inches; reddish brown (5YR 4/4) sandy loam; massive; friable; about 10 percent gravel; moderately acid.

The thickness of the solum ranges from 40 to more than 60 inches. The thickness of the silty mantle ranges from 36 to 60 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon, which has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. The 2C horizon has hue of 2.5YR, 5YR, or 7.5YR and value and chroma of 4 to 6. It is sandy loam, loam, or the gravelly analogs of these textures.

Plainbo Series

The Plainbo series consists of excessively drained soils on stream terraces and on uplands. These soils are moderately deep to sandstone. They formed in sandy eolian or alluvial deposits underlain by sandstone. Permeability is rapid in the subsoil and moderately slow or moderate in the sandstone. Slope ranges from 2 to 20 percent.

Typical pedon of Plainbo loamy sand, 6 to 12 percent slopes, 400 feet north and 1,800 feet west of the southeast corner of sec. 29, T. 32 N., R. 11 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

Bw1—9 to 16 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; few fine roots; slightly acid; clear smooth boundary.

Bw2—16 to 21 inches; yellowish brown (10YR 5/6) sand; weak coarse subangular blocky structure; very friable; few fine roots; strongly acid; clear smooth boundary.

BC—21 to 35 inches; brownish yellow (10YR 6/6) sand; single grain; loose; few fine roots; strongly acid; clear smooth boundary.

Cr—35 to 60 inches; very pale brown (10YR 7/3) sandstone.

The thickness of the solum and the depth to soft sandstone range from 20 to 40 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon, which has value of 2 or 3 and chroma of 1 or 2. The Bw and BC horizons have hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 4 to 8. The sandstone is a Cr horizon in at least the upper 10 inches. It grades to an R layer with increasing depth in some pedons.

Poskin Series

The Poskin series consists of very deep, somewhat poorly drained soils on outwash plains. These soils are moderately deep to sandy outwash. They formed mostly in loess or silty alluvium underlain by stratified sandy outwash. Permeability is moderate in the silty mantle, moderate or moderately rapid in the loamy lower part of the subsoil, and rapid or very rapid in the sandy outwash. Slope ranges from 0 to 2 percent.

Typical pedon of Poskin silt loam, 0 to 2 percent slopes, 2,190 feet south and 1,340 feet west of the northeast corner of sec. 16, T. 35 N., R. 10 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

E—9 to 12 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; slightly acid; clear wavy boundary.

E/B—12 to 19 inches; about 70 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few distinct dark brown (7.5YR 4/4) clay films on faces of peds; few fine roots; common medium faint and

distinct light brownish gray (10YR 6/2) iron depletions and few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; moderately acid; clear wavy boundary.

Bt1—19 to 27 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark brown (7.5YR 4/4) clay films on faces of peds; common medium distinct light brownish gray (10YR 6/2) iron depletions and common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; strongly acid; clear wavy boundary.

Bt2—27 to 36 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark brown (7.5YR 4/2) clay films on faces of peds; common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation and common medium prominent grayish brown (10YR 5/2) iron depletions; about 2 percent gravel; strongly acid; clear wavy boundary.

2Bt3—36 to 39 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few distinct dark brown (7.5YR 4/2) clay films on faces of peds; few medium distinct strong brown (7.5YR 5/6) masses of iron accumulation; about 8 percent gravel; moderately acid; clear smooth boundary.

3C—39 to 60 inches; reddish brown (5YR 4/4), stratified gravelly sand and sand; single grain; loose; few fine distinct yellowish red (5YR 4/6) masses of iron accumulation; about 20 percent gravel (as an average); about 5 percent cobbles; moderately acid.

The thickness of the solum, the thickness of the silty mantle, and the depth to sandy outwash range from 20 to 40 inches.

The Ap or A horizon has value of 3 or 4 and chroma of 1 to 3. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam, loam, or the gravelly analogs of these textures. Some pedons have a 3Bt horizon. This horizon has colors similar to those of the 3C horizon. It is loamy sand, loamy coarse sand, or the gravelly or very gravelly analogs of these textures. The 3C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 2 to 6. It is stratified with sand, coarse sand, or the gravelly or very gravelly analogs of these textures. The content of gravel ranges from 3 to 45 percent, as an average, in the sandy outwash and ranges from 0 to 60 percent in individual strata.

Quarderer Series

The Quarderer series consists of very deep, moderately well drained, moderately permeable soils in drainageways on uplands. These soils formed in silty alluvium. Slope ranges from 0 to 3 percent.

Typical pedon of Quarderer silt loam, 0 to 3 percent slopes, 2,240 feet south and 1,140 feet east of the northwest corner of sec. 22, T. 32 N., R. 12 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; common fine and medium roots; strongly acid; clear smooth boundary.

A—10 to 13 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; friable; common fine and medium roots; very strongly acid; clear smooth boundary.

C—13 to 22 inches; stratified, very dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 4/4) silt loam; massive; friable; breaks along depositional strata to medium and thick platy fragments; few fine roots; moderately acid; clear smooth boundary.

Ab1—22 to 26 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; friable; few fine roots; moderately acid; clear smooth boundary.

Ab2—26 to 29 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate medium platy structure; friable; few fine roots; moderately acid; clear smooth boundary.

Btb1—29 to 39 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; common faint brown (10YR 4/3) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Btb2—39 to 48 inches; dark yellowish brown (10YR 4/4) silt loam; strong medium subangular blocky structure; friable; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

Btb3—48 to 55 inches; dark yellowish brown (10YR

4/4) silt loam; moderate coarse subangular blocky structure; friable; common distinct dark brown (7.5YR 4/4) clay films on faces of peds; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation; very strongly acid; clear smooth boundary.

C′—55 to 72 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation; very strongly acid.

The depth to the Ab horizon ranges from 20 to 60 inches.

The A horizon has value and chroma of 2 or 3. The C horizon has value of 3 to 5 and chroma of 2 to 6. The Ab horizon has value of 2 or 3 and chroma of 1 to 3. The Btb horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. The C′ horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6.

Rib Series

The Rib series consists of very deep, poorly drained soils on outwash plains and stream terraces. These soils are moderately deep to sandy outwash. They formed mostly in silty alluvium underlain by sandy outwash. Permeability is moderate in the silty alluvium, moderate or moderately rapid in the loamy lower part of the subsoil, and rapid or very rapid in the substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Rib silt loam, 0 to 2 percent slopes, 900 feet north and 200 feet west of the southeast corner of sec. 11, T. 36 N., R. 10 W.

A—0 to 8 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak medium granular structure; friable; many fine and medium roots; moderately acid; abrupt wavy boundary.

Bg1—8 to 16 inches; grayish brown (2.5Y 5/2) silt loam; moderate coarse subangular blocky structure; friable; common fine roots; few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation; strongly acid; clear wavy boundary.

Bg2—16 to 32 inches; light brownish gray (2.5Y 6/2) silt loam; weak coarse subangular blocky structure; friable; many medium prominent yellowish brown (10YR 5/6) masses of iron accumulation; moderately acid; clear wavy boundary.

2Bg3—32 to 36 inches; light brownish gray (10YR 6/2) gravelly loam; weak coarse subangular blocky structure; friable; common medium prominent strong brown (7.5YR 5/8) masses of iron accumulation; about 20 percent gravel; strongly acid; clear wavy boundary.

2C—36 to 60 inches; brown (10YR 4/3), stratified very gravelly sand and gravelly sand; single grain; loose; about 40 percent gravel (as an average); moderately acid.

The thickness of the solum, the thickness of the silty mantle, and the depth to sandy outwash range from 24 to 40 inches.

The Ap or A horizon 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 or silty clay loam. The 2Bg horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is sandy loam, loam, or the gravelly or very gravelly analogs of these textures. The content of gravel ranges from 2 to 40 percent in the 2Bg horizon. Some pedons have a 3B horizon. This horizon has colors similar to those of the 3C horizon. It is loamy sand, loamy coarse sand, or the gravelly or very gravelly analogs of these textures. The 3C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 8, and chroma of 1 to 6. The content of gravel ranges from 3 to 45 percent, as an average, in the sandy outwash and ranges from 0 to 60 percent in individual strata.

Ribhill Series

The Ribhill series consists of well drained soils on quartzite monadnocks. These soils are moderately deep to quartzite bedrock. They formed in loess and loamy glacial till underlain by quartzite. Permeability is moderate in the soil material and very slow to rapid in the quartzite bedrock. Slope ranges from 2 to 40 percent.

Typical pedon of Ribhill cobbly silt loam, 2 to 15 percent slopes, very stony, 2,300 feet north and 100 feet west of the center of sec. 34, T. 35 N., R. 10 W.

A—0 to 3 inches; very dark brown (10YR 2/2) cobbly silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many fine and medium roots; about 3 percent gravel, 20 percent cobbles, and 3 percent stones; strongly acid; abrupt smooth boundary.

E—3 to 6 inches; brown (10YR 4/3) cobbly silt loam, pale brown (10YR 6/3) dry; moderate fine and very fine subangular blocky structure; friable; many fine and medium roots; about 3 percent gravel, 20 percent cobbles, and 5 percent stones; strongly acid; clear smooth boundary.

B/E—6 to 13 inches; about 80 percent dark yellowish brown (10YR 4/4) very cobbly silt loam (Bt);

moderate medium subangular blocky structure; friable; few faint dark brown (7.5YR 4/4) clay films on faces of peds; penetrated by tongues of yellowish brown (10YR 5/3) very cobbly silt loam (E), very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; friable; many fine and medium roots; about 6 percent gravel, 25 percent cobbles, and 5 percent stones; moderately acid; clear smooth boundary.

Bt1—13 to 17 inches; dark brown (7.5YR 4/4) cobbly silt loam; moderate medium subangular blocky structure; friable; few fine and medium roots; few faint dark brown (7.5YR 4/4) clay films on faces of peds; about 2 percent gravel, 25 percent cobbles, and 5 percent stones; moderately acid; clear smooth boundary.

2Bt2—17 to 23 inches; reddish brown (5YR 4/4) cobbly loam; moderate medium subangular blocky structure; friable; few fine and medium roots; few distinct dark reddish gray (5YR 4/2) clay films on faces of peds; about 1 percent gravel, 30 percent cobbles, and 5 percent stones; strongly acid; clear smooth boundary.

2Bt3—23 to 38 inches; dark brown (7.5YR 4/4) very cobbly sandy loam; moderate coarse subangular blocky structure; friable; few prominent dark reddish brown (5YR 3/2) clay films on faces of peds; few fine roots; about 9 percent gravel, 30 percent cobbles, and 5 percent stones; strongly acid; abrupt smooth boundary.

3R—38 inches; fractured quartzite with strong brown (7.5YR 5/6) sandy loam in joints.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 4 or 5 and chroma of 2 or 3. It is cobbly silt loam or very cobbly silt loam. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon. The Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 4 or 5. It is cobbly silt loam or very cobbly silt loam. The 2Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is cobbly sandy loam, cobbly loam, very cobbly sandy loam, or very cobbly loam.

Rosholt Series

The Rosholt series consists of very deep, well drained soils on outwash plains and stream terraces. These soils are moderately deep to sandy outwash. They formed in loamy alluvium and sandy outwash. Permeability is moderate or moderately rapid in the loamy alluvium and rapid or very rapid in the sandy outwash. Slope ranges from 0 to 25 percent.

Typical pedon of Rosholt loam, 2 to 6 percent slopes, 500 feet north and 400 feet east of the southwest corner of sec. 14, T. 33 N., R. 10 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

E—8 to 11 inches; brown (10YR 5/3) loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; common fine roots; slightly acid; clear smooth boundary.

B/E—11 to 20 inches; about 80 percent dark brown (7.5YR 4/4) loam (Bt); moderate medium subangular blocky structure; friable; few faint dark brown (7.5YR 3/4) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bt1—20 to 28 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; few fine roots; few distinct reddish brown (5YR 4/4) clay films on faces of peds; moderately acid; clear smooth boundary.

Bt2—28 to 32 inches; reddish brown (5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark reddish gray (5YR 4/2) clay films on faces of peds; about 10 percent gravel; moderately acid; clear smooth boundary.

2Bt3—32 to 36 inches; dark brown (7.5YR 4/4) gravelly loamy sand; weak coarse subangular blocky structure; very friable; dark reddish gray (5YR 5/2) clay bridges between sand grains; about 30 percent gravel; moderately acid; clear smooth boundary.

2C—36 to 60 inches; strong brown (7.5YR 5/6), stratified very gravelly sand and gravelly sand; single grain; loose; about 50 percent gravel (as an average); strongly acid.

The thickness of the solum ranges from 20 to 40 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon, which has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the

Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, loam, or the gravelly analogs of these textures. The 2Bt horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is loamy sand, loamy coarse sand, or the gravelly or very gravelly analogs of these textures. The 2C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is stratified with sand, coarse sand, or the gravelly or very gravelly analogs of these textures.

Santiago Series

The Santiago series consists of well drained soils on ground moraines. These soils are deep or very deep to dense till. They formed in loess or other silty deposits and in the underlying dense loamy glacial till. Permeability is moderate in the silty mantle, slow or moderately slow in the loamy lower part of the subsoil, and very slow in the substratum. Slope ranges from 2 to 20 percent.

Typical pedon of Santiago silt loam, 6 to 12 percent slopes, eroded, 1,840 feet south and 2,040 feet east of the northwest corner of sec. 34, T. 32 N., R. 14 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine and few medium roots; 4 percent gravel; slightly acid; abrupt smooth boundary.

E/B—10 to 15 inches; about 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure parting to moderate very fine subangular blocky; friable; tonguing into or surrounding remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate very fine subangular blocky structure; friable; common faint dark yellowish brown (10YR 3/4) clay films on faces of peds; common fine and few medium roots; 1 percent gravel; moderately acid; clear smooth boundary.

B/E—15 to 23 inches; about 70 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate very fine subangular blocky structure; friable; common faint dark yellowish brown (10YR 3/4) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; weak medium platy structure parting to moderate fine subangular blocky; friable; common fine and few medium roots; 1 percent gravel; very strongly acid; abrupt wavy boundary.

2Bt1—23 to 36 inches; dark brown (7.5YR 3/4) gravelly sandy loam; moderate fine subangular blocky structure; friable; tends to part along horizontal cleavage planes inherited from the parent material; common fine roots; common faint dark brown (7.5YR 3/4) and few distinct reddish brown (5YR 4/4) clay films on faces of peds; 14 percent gravel, about 1 percent cobbles; strongly acid; abrupt wavy boundary.

2Bt2—36 to 49 inches; dark brown (7.5YR 3/4) fine sandy loam; moderate fine subangular blocky structure; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; many faint dark brown (7.5YR 3/3) clay films on faces of peds; 11 percent gravel, about 1 percent cobbles; slightly brittle; strongly acid; gradual wavy boundary.

2Bt3—49 to 69 inches; dark reddish brown (5YR 3/4) sandy loam; moderate fine subangular blocky structure; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; common faint dark reddish brown (5YR 3/3) clay films on faces of peds; 9 percent gravel, about 1 percent cobbles; moderately acid; gradual wavy boundary.

2Bt4—69 to 87 inches; dark reddish brown (5YR 3/4) sandy loam; moderate fine subangular blocky structure; friable; tends to part along horizontal cleavage planes inherited from the parent material; few fine roots; common faint dark reddish brown (5YR 3/3) clay films on faces of peds; 7 percent gravel, about 1 percent cobbles; few sandstone channers; moderately acid; gradual wavy boundary.

2Cd—87 to 99 inches; reddish brown (5YR 4/4) sandy loam; massive; firm; tends to break to weak medium plates; 9 percent gravel, about 1 percent cobbles; slightly acid.

The thickness of the solum ranges from 40 to more than 80 inches. The thickness of the silty mantle ranges from 12 to 36 inches.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. Pedons in uncultivated areas have an A horizon, which has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, and value of 3 to 5, and chroma of 4 to 6. The 2Bt horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is fine sandy loam, sandy loam, loam, or the gravelly analogs of these textures.

Scoba Series

The Scoba series consists of very deep, moderately well drained soils on outwash plains. These soils are moderately deep to sandy outwash. They formed in loamy alluvium and stratified sandy outwash. Permeability is moderate in the loamy alluvium and rapid or very rapid in the sandy outwash. Slope ranges from 0 to 3 percent.

Typical pedon of Scoba sandy loam, 0 to 3 percent slopes, 600 feet north and 300 feet east of the southwest corner of sec. 2, T. 33 N., R. 10 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; common fine roots; about 1 percent gravel; moderately acid; abrupt smooth boundary.

E/B—9 to 16 inches; about 70 percent brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into and surrounding remnants of dark yellowish brown (10YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few distinct dark brown (7.5YR 4/3) clay films on faces of peds; few fine roots; about 1 percent gravel; moderately acid; clear wavy boundary.

B/E—16 to 20 inches; about 70 percent dark yellowish brown (10YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few distinct dark brown (7.5YR 4/3) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) sandy loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; about 3 percent gravel; moderately acid; clear wavy boundary.

Bt1—20 to 26 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; few faint dark brown (7.5YR 3/4) clay films on faces of peds; common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation; about 3 percent gravel; strongly acid; clear wavy boundary.

2Bt2—26 to 31 inches; dark brown (7.5YR 4/4) loamy sand; moderate coarse subangular blocky structure; friable; few fine roots; common faint dark brown (7.5YR 3/4) clay bridges between mineral grains; common medium distinct strong brown (7.5YR 5/6) masses of iron accumulation; about 10 percent gravel; strongly acid; abrupt wavy boundary.

2C—31 to 60 inches; strong brown (7.5YR 5/6), stratified sand and gravelly sand; single grain; loose; about 20 percent gravel (as an average); strongly acid.

The thickness of the solum, the thickness of the loamy mantle, and the depth to sandy outwash range from 20 to 40 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon, if it occurs, has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam or loam or the gravelly analogs of these textures. The content of gravel ranges from 1 to 35 percent in the loamy mantle. The 2Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loamy sand, loamy coarse sand, or the gravelly or very gravelly analogs of these textures. The 2C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is stratified sand, coarse sand, or the gravelly or very gravelly analogs of these textures. The content of gravel ranges from 3 to 45 percent, as an average, in the sandy outwash and from 0 to 60 percent in individual strata.

Seelyeville Series

The Seelyeville series consists of very deep, very poorly drained soils in depressions and slightly concave areas on outwash plains and moraines. These soils formed in more than 51 inches of herbaceous organic material. Permeability is moderately slow to moderately rapid. Slope is 0 to 1 percent.

Typical pedon of Seelyeville muck, in an area of Seelyeville and Cathro mucks, 0 to 1 percent slopes, 100 feet south and 2,300 feet east of the northwest corner of sec. 9, T. 36 N., R. 10 W.

Oa1—0 to 8 inches; muck, black (10YR 2/1) broken face, pressed, and rubbed; about 50 percent fiber, 10 percent rubbed; weak medium subangular blocky structure; nonsticky; herbaceous fibers; moderately acid (pH 6.0 in water); clear smooth boundary.

Oa2—8 to 24 inches; muck, very dark brown (10YR 2/2) broken face, pressed, and rubbed; about 30 percent fiber, 10 percent rubbed; weak medium subangular blocky structure; slightly sticky; herbaceous fibers; moderately acid (pH 6.0 in water); clear smooth boundary.

Oa3—24 to 36 inches; muck, very dark brown (10YR 2/2) broken face, pressed, and rubbed; about 20 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; slightly sticky; herbaceous fibers; moderately acid (pH 6.0 in water); clear smooth boundary.

Oa4—36 to 60 inches; muck, very dark brown (10YR 2/2) broken face, pressed, and rubbed; about 15 percent fiber, less than 5 percent rubbed; massive; slightly sticky; herbaceous fibers; moderately acid (pH 6.0 in water).

The organic material is more than 51 inches thick. It is typically muck, but some pedons have layers of mucky peat and peat. The combined thickness of these layers is less than 10 inches. Some pedons have a surface cover of sphagnum moss less than 8 inches thick.

The muck has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2.

Siouxcreek Series

The Siouxcreek series consists of somewhat poorly drained soils on uplands. These soils are moderately deep to sandstone. They formed in silty and loamy alluvium and loamy till underlain by sandy residuum and sandstone. Permeability is moderate in the loamy mantle, moderately rapid or rapid in the sandy residuum, and moderately slow or moderate in the sandstone. Slope ranges from 0 to 3 percent.

Typical pedon of Siouxcreek silt loam, 0 to 3 percent slopes, 200 feet north and 2,300 feet west of the southeast corner of sec. 16, T. 32 N., R. 10 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common fine and medium roots; about 2 percent gravel; neutral; abrupt smooth boundary.

E—8 to 10 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate thin platy structure; friable; common fine and medium roots; about 2 percent gravel; slightly acid; clear smooth boundary.

E/B—10 to 14 inches; about 60 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few fine roots; common medium prominent and distinct yellowish brown (10YR 5/8) masses of iron accumulation and few medium faint and distinct light brownish gray (10YR 6/2) iron depletions; about 3 percent gravel; neutral; clear smooth boundary.

B/E—14 to 22 inches; about 60 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; common coarse prominent strong brown (7.5YR 5/8) masses of iron accumulation and many medium distinct and faint light brownish gray (10YR 6/2) iron depletions; about 5 percent gravel; strongly acid; clear smooth boundary.

Bt1—22 to 29 inches; dark yellowish brown (10YR 4/4) fine sandy loam; moderate medium subangular blocky structure; friable; few fine roots; few faint dark brown (10YR 4/3) clay films on faces of peds; many coarse prominent strong brown (7.5YR 5/8) masses of iron accumulation and many medium distinct light brownish gray (10YR 6/2) iron depletions; about 3 percent gravel; very strongly acid; clear smooth boundary.

Bt2—29 to 32 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; many coarse prominent strong brown (7.5YR 5/8) masses of iron accumulation and many medium distinct light brownish gray (10YR 6/2) iron depletions; about 3 percent gravel; very strongly acid; clear smooth boundary.

2BC—32 to 38 inches; light yellowish brown (2.5Y 6/4) fine sand; single grain; loose; few fine roots; few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation; about 2 percent sandstone channers; strongly acid; clear smooth boundary.

2Cr—38 to 60 inches; light olive brown (2.5Y 5/4), fine grained sandstone.

The thickness of the loamy mantle and the depth to sandy residuum range from 20 to 39 inches. The depth to soft sandstone ranges from 20 to 40 inches. The volume of gravel in the loamy mantle ranges from 0 to 5 percent. The volume of sandstone channers in the sandy residuum also ranges from 0 to 5 percent.

The Ap or A horizon has value of 2 to 4 and chroma of 1 to 3. The E horizon has value of 4 to 6 and chroma of 2 or 3. It is silt loam, loam, sandy loam, fine sandy loam, or very fine sandy loam. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt

horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam, loam, or fine sandy loam. The 2BC or 2Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 7, and chroma of 4 to 6. It is fine sand, loamy fine sand, loamy sand, or sand.

Spencer Series

The Spencer series consists of very deep, moderately well drained soils on ground moraines. These soils formed in loess or other silty deposits and in the underlying loamy glacial till. Permeability is moderate in the silty mantle and moderately slow or moderate in the till. Slope ranges from 2 to 12 percent.

Typical pedon of Spencer silt loam, 2 to 6 percent slopes, 2,000 feet south and 100 feet east of the northwest corner of sec. 18, T. 34 N., R. 13 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine and medium roots; neutral; abrupt smooth boundary.

E—9 to 12 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; common fine and medium roots; slightly acid; clear smooth boundary.

E/B—12 to 22 inches; about 70 percent brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; tonguing into or surrounding remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common fine and medium roots; strongly acid; clear smooth boundary.

B/E—22 to 30 inches; about 60 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; common faint dark yellowish brown (10YR 3/4) clay films on faces of peds; penetrated by tongues of brown (10YR 5/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; common fine and medium roots; strongly acid; clear smooth boundary.

Bt1—30 to 42 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common faint dark yellowish brown (10YR 3/4) clay films on faces of peds; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation; about 3 percent gravel; strongly acid; clear smooth boundary.

2Bt2—42 to 48 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds; few fine distinct strong brown (7.5YR 5/6) masses of iron accumulation; about 10 percent gravel and 2 percent cobbles; strongly acid; clear smooth boundary.

2C—48 to 72 inches; reddish brown (5YR 4/4) sandy loam; massive; friable; about 10 percent gravel and 2 percent cobbles; moderately acid.

The thickness of the solum ranges from 30 to more than 80 inches. The thickness of the silty mantle ranges from 36 to 60 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon, which has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 2 or 3. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. The 2Bt horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is loam, sandy loam, or the gravelly analogs of these textures. The 2C horizon has colors and textures similar to those of the 2Bt horizon.

Twinmound Series

The Twinmound series consists of excessively drained soils on uplands. These soils are moderately deep to soft sandstone. They formed in siliceous sandy residuum derived from the underlying sandstone. Permeability is rapid in the subsoil and moderately slow or moderate in the sandstone. Slope ranges from 20 to 50 percent.

Typical pedon of Twinmound sand, in an area of Hayriver-Twinmound complex, 20 to 50 percent slopes, 800 feet south and 1,200 feet east of the northwest corner of sec. 3, T. 32 N., R. 13 W.

A—0 to 4 inches; dark brown (10YR 3/3) sand, brown (10YR 5/3) dry; weak fine granular structure; very friable; common fine and medium roots; strongly acid; clear smooth boundary.

Bw1—4 to 9 inches; dark yellowish brown (10YR 3/4) sand; weak medium subangular blocky structure; very friable; common fine and medium roots; strongly acid; clear smooth boundary.

Bw2—9 to 18 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; few fine roots; strongly acid; clear smooth boundary.

Bw3—18 to 28 inches; strong brown (7.5YR 4/6) sand; single grain; loose; few fine roots; moderately acid; clear smooth boundary.

Cr—28 to 42 inches; yellowish brown (10YR 5/6) sandstone.
R—42 inches; yellowish brown (10YR 5/6) sandstone.

The thickness of the solum and the depth to sandstone range from 20 to 40 inches.

The A horizon has value of 2 to 4 and chroma of 1 to 3. The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 4 to 6. Some pedons have a BC horizon. This horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 5 or 6, and chroma of 3 to 8. It is sand, fine sand, or the channery analogs of these textures. The sandstone is a Cr horizon in at least the upper 10 inches and typically grades to an R layer with increasing depth.

Vancecreek Series

The Vancecreek series consists of very deep, poorly drained, moderately permeable soils on flood plains and in drainageways. These soils formed in silty alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Vancecreek silt loam, 0 to 2 percent slopes, 990 feet north and 2,040 feet west of the southeast corner of sec. 35, T. 32 N., R. 14 W.

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many fine and medium roots; moderately acid; abrupt wavy boundary.
A2—10 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; friable; few fine and medium roots; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; moderately acid; abrupt wavy boundary.
Bg1—16 to 26 inches; grayish brown (2.5Y 5/2) silt loam; moderate medium subangular blocky structure; friable; few fine and medium roots; few medium prominent yellowish brown (10YR 5/6) masses of iron accumulation; moderately acid; gradual wavy boundary.
Bg2—26 to 35 inches; olive gray (5Y 5/2) silt loam; moderate coarse prismatic structure parting to weak medium subangular blocky; friable; few fine and medium roots; few prominent dark gray (10YR 4/1) organic stains in root channels; few medium prominent yellowish brown (10YR 5/6) masses of iron accumulation; slightly acid; gradual wavy boundary.
Bg3—35 to 49 inches; olive gray (5Y 5/2) silt loam; weak coarse subangular blocky structure; friable; few fine and medium roots; few prominent dark gray (10YR 4/1) organic stains in root channels; few medium prominent yellowish brown (10YR 5/6) masses of iron accumulation; slightly acid; gradual wavy boundary.
Cg—49 to 60 inches; dark greenish gray (5GY 4/1) silt loam; massive; friable; few medium prominent strong brown (7.5YR 5/6) masses of iron accumulation; slightly alkaline.

The thickness of the solum ranges from 30 to 50 inches.

The A horizon 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. The C horizon has hue of 2.5Y, 5Y, or 5GY, value of 4 to 6, and chroma of 1 to 4.

Wickware Series

The Wickware series consists of very deep, well drained, moderately permeable soils on valley sides. These soils formed in silty colluvium. Slope ranges from 6 to 20 percent.

Typical pedon of Wickware silt loam, 6 to 12 percent slopes, eroded, 1,800 feet south and 600 feet east of the northwest corner of sec. 19, T. 32 N., R. 12 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine and medium roots; neutral; abrupt smooth boundary.
B/E—10 to 17 inches; about 60 percent dark yellowish brown (10YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; penetrated by tongues of pale brown (10YR 6/3) silt loam (E), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; few fine roots; slightly acid; clear smooth boundary.
Bt1—17 to 25 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; many faint dark brown (7.5YR 3/4) clay films on faces of peds; common prominent very pale brown (10YR 7/3) coatings of clean silt grains on the vertical faces of peds; slightly acid; clear wavy boundary.
Bt2—25 to 32 inches; strong brown (7.5YR 4/6) silt loam; moderate coarse subangular blocky structure; friable; few fine roots; many distinct dark brown (7.5YR 3/4) clay films on faces of peds; slightly acid; clear wavy boundary.
Bt3—32 to 36 inches; strong brown (7.5YR 4/6) silt loam; weak coarse subangular blocky structure;

friable; few fine roots; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; moderately acid; clear wavy boundary.

C—36 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; strongly acid.

The thickness of the solum ranges from 30 to 50 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon, which has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. All pedons have an E/B or B/E horizon, or both. The E part of the E/B or B/E horizon has colors and textures similar to those of the E horizon, and the Bt part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The C horizon has value and chroma of 4 to 6.

Formation of the Soils

This section describes the geology and underlying material in Barron County, relates the factors of soil formation to the soils in the county, and explains the processes of soil formation.

Geology and Underlying Material

Michael T. McCawley, geologist, Natural Resources Conservation Service, helped prepare this section.

Barron County lies in three Wisconsin geomorphic provinces. Most of the county lies in the Central Plains Province, which is mainly underlain by weakly cemented Cambrian sandstone. The Western Upland Province is underlain by dolomite. The Northern Highland Province consists of a small area of Precambrian quartzite in the eastern part of the county. This area is known as the Blue Hills. The bedrock terrain has been modified by glaciation and is covered by Pleistocene deposits and windblown silts. Only in the southern part of the county, where sandstone is commonly exposed along valley sides, does the sandstone have a pronounced influence on the surface topography.

Glaciers, streams, and lakes were responsible for the character of the Pleistocene deposits in Barron County (Johnson, 1986). These deposits form an almost continuous cover in the northern two-thirds of the county. In places they bury the Cambrian sediment to a depth of as much as 300 feet. Loess covered the survey area shortly after the glacial ice melted.

During the Pleistocene Epoch, from about 1,600,000 to 10,000 years ago, glaciers advanced into the area many times, eroding preexisting rock, sediments, and till. The till deposited during at least six of the advances is red and sandy, whereas the till of the earliest known glaciation is gray and clayey. Till was deposited by ice advancing into the area at different times. These advances were the Superior Lobe from the northwest, the Chippewa Lobe from the northeast, and the Des Moines Lobe from the west. The youngest glacial deposits are about 15,000 years old, and the oldest deposits are several hundred thousand years old. The variety of deposits, the interaction of different lobes, and the long time span of glacial activity resulted in the complexity and variety of the glacial geology of Barron County.

The main economic mineral resources of Barron County are sand and gravel from glacial outwash. There are about 100 gravel pits in the county.

Other mineral resources include the Cambrian sandstone, used locally for roadfill, and some of the Precambrian igneous and metamorphic rocks, which are crushed and used for decorative or landscape uses.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any point are determined by the physical and mineral composition of the parent material, the climate under which the soil material has been accumulated and has existed since accumulation, the plant and animal life on and in the soil, the relief and drainage, and the length of time that the forces of soil formation have acted on the soil material.

Climate and vegetation are active factors of soil formation. They act on parent material that has accumulated through the weathering or physical disintegration of rock and slowly change it into a natural body that has genetically related horizons. The effects of climate and of plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in some areas, determines it almost entirely. Finally, time is needed for the transformation of the parent material into soil. Some time is always needed for the differentiation of soil horizons. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects 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. Silty deposits (loess), glacial till, and outwash are the dominant kinds of parent material in the county. Lacustrine deposits, organic material, alluvium, and material weathered from sandstone also are common. Some soils formed in more than one kind of parent material.

Glacial till is unstratified, unsorted glacial debris made up mainly of clay, silt, and sand. It may contain gravel, cobbles, stones, or boulders. The Cary till in Barron County is dominantly sandy loam, but in some areas it is loamy sand. Amery soils are examples of soils that formed in loamy deposits and in the underlying sandy loam till. Freeon, Magnor, and Santiago soils formed in silty deposits and in the underlying loamy till.

Glacial outwash is sand, sand and gravel, or stratified sand and gravel deposited by water flowing from a melting glacier. Anigon, Brill, and Poskin soils are examples of soils that formed mostly in silty alluvium over sand and gravel outwash. Chetek and Rosholt soils formed mostly in loamy alluvium over sand and gravel outwash. Friendship, Meehan, and Menahga soils are examples of soils that formed entirely in sandy outwash. These soils do not have a layer of clay accumulation and show little evidence of subsoil development.

Lacustrine deposits are mainly silty but have thin strata of sandy material in some areas. These sediments were deposited in the still water of glacial lakes. Campia, Comstock, and Crystal Lake soils formed in silty lacustrine deposits.

Some soils in the county formed partially or entirely in residuum derived from sandstone. Dobie soils formed in loess and loamy residuum underlain by sandstone. Hayriver soils formed in loamy residuum underlain by sandstone residuum and sandstone. Plainbo soils formed in sandy outwash deposits underlain by sandstone.

Organic material consists of reeds, sedges, grasses, and other plant material or woody fragments in various stages of decomposition. Beseman, Cathro, and Markey soils formed in organic material 16 to 51 inches thick over mineral deposits. Greenwood and Seelyeville soils formed in organic material more than 51 inches thick.

Alluvial deposits are of relatively recent origin. Most of the soils that formed in these deposits do not have distinct horizons. Alluvial material is deposited on flood plains or is washed into drainageways locally from higher positions on the landscape. Fordum soils formed in silty and loamy alluvium underlain by sandy alluvium. Quarderer and Vancecreek soils formed in silty alluvium.

Climate

Climate influences soil formation through its effect on the moisture supply in the soil and on soil temperature. Climate affects the weathering of rocks and the alteration of the parent material through the mechanical action of freezing and thawing and the chemical action generated by the leaching of water.

Climate also indirectly influences soil formation through its effect on plant and animal life. Climatic factors influence the rate of plant growth and thus also influence the accumulation of organic matter in the soil and the level of soil fertility.

Barron County has a cool, subhumid continental climate characteristic of the north-central part of the United States. Climatic differences within the county are too small to have resulted in major differences among the soils.

Plant and Animal Life

Living organisms influence soil formation mainly through the effect of vegetation on the accumulation of organic matter in the soil. Bacteria, fungi, and earthworms also affect soil formation. Plant and animal life add organic material to the soil and translocate plant nutrients from lower to upper layers.

When the first settlers arrived in the survey area, the native vegetation in most of the area was mixed conifers and hardwoods. Small areas of pine barrens were on the sandy outwash plains in the southern part of the county. The native vegetation has resulted in light colored soils that have a relatively low content of organic matter.

Relief and Drainage

Relief in Barron County is affected by geologic and hydrographic factors. Hills, valleys, terraces, and outwash plains formed as a result of rain, wind, rivers, glacial meltwater, and glacial deposition. Where sandstone is the controlling factor of the topography, the resistance of the underlying rocks to weathering has determined the relief.

Drainage characteristics generally are reflected in the color, degree, and kind of mottling or gleying in the soil horizons. Well drained to excessively drained soils have no mottles. Examples are Menahga, Otterholt, and Rosholt soils. Moderately well drained soils, such as Crystal Lake, Friendship, and Spencer soils, have

bright colored mottles in the B horizon. Comstock, Magnor, Poskin, and other somewhat poorly drained soils have both bright colored and grayish mottles in the B horizon. The very poorly drained Adolph soils and the poorly drained Newson and Rib soils are dominantly gray or gleyed in the B horizon.

Time

The length of time required for the formation of a given soil depends on the other factors of soil formation. Most of the soils in Barron County formed in material deposited at about the time of the last glaciation. Thus, the soils are about 10,000 years old.

Processes of Soil Formation

A combination of basic processes is responsible for horizon differentiation. The main processes are gains, losses, transfers, and transformations. These processes can be active in all soils. Some changes promote horizon differentiation, and others retard it. The nature of the soil at any given point is the net result of all the changes (Simonson, 1959).

The interaction among these soil-forming processes is evident in Anigon soils. These soils formed mostly in loess or silty alluvium and loamy alluvium underlain by sandy outwash. The loess or silty alluvium was deposited during or shortly after the last glaciation. Because these soils are rather high on the landscape and are underlain by porous sand and gravel, they are well drained. The climate favored the growth of trees. Plants and animals contributed to the accumulation of organic matter and organic acids and darkened the surface layer.

As rainwater moved downward through these soils, suspended particles of clay were translocated from the surface soil to the subsoil. This clay occurs as clay films on the faces of peds. As a result of this transfer, the soils have more clay in the subsoil than in other horizons.

While these changes occurred in the silty part of the profile, chemical weathering of minerals in the underlying sandy outwash and mixing with the silty deposits gradually changed the lower part of the subsoil to loam. Because of oxidized iron, this layer is darker than the underlying unweathered sandy outwash.

As a result of the soil-forming processes, Anigon soils have a dark brown surface layer, tongues in the subsurface layer that extend into the upper part of the subsoil, and clay films and dark brown colors in the middle and lower parts of the subsoil. All of the soil-forming processes are active in the soils of Barron County. In some soils certain processes are more active than others. The kinds of parent material and the relief have to a great extent determined the kinds of processes that are dominant in the formation of the soils.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

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.

Aspect. The direction in which a slope faces.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock outcrop (map symbol). A small exposure of bedrock.

Board foot. A unit of measurement represented by a board 1 foot wide, 1 foot long, and 1 inch thick.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

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.

Clearcutting. Removal of all the timber in a stand when trees are harvested.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded

rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

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. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

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.

Cord. A unit of measurement of stacked wood. A standard cord occupies 128 cubic feet with dimensions of 4 feet by 4 feet by 8 feet.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

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.

Critical-area planting. Planting vegetation to stabilize highly erodible or critically eroding areas. The areas generally cannot be stabilized by ordinary conservation treatment and management, and if they are left untreated, severe erosion or sediment damage can result.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The depth to a root-restricting layer or horizon. The depth classes in Barron County are:

Shallow	10 to 20 inches
Moderately deep	20 to 40 inches
Deep	40 to 60 inches
Very deep	more than 60 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 wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained.* These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

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 human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide 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.

Field border. A strip of perennial vegetation established at the edge of a field.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift. 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. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glauconite. A complex potassium-iron-silicate mineral disseminated as green flakes or grains in marine sedimentary rocks.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

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 as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 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. Water filling all the unblocked pores of the material below the water table.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. 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. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil 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, a plowed surface horizon, most of which was originally part of a B horizon.
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 A horizon. The B horizon is in part a layer of transition from the overlying A 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) 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 soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Irrigation. Application of water to soils to assist in production of crops.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

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. General term for the textural classes very fine sandy loam, fine sandy loam, sandy loam, coarse sandy loam, loam, clay loam, and sandy clay loam.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

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.

Moraine. 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. 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, 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 with hue of 10YR, value of 6, and chroma of 4.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. It is described as the percent organic matter, by weight, of the

material less than 2 millimeters in diameter. Terms describing organic matter content are:

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 that contains 12 to more than 18 percent organic carbon, depending on the content of mineral materials, and is 16 or more 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 generally is 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.)

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.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 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, such as slope, stoniness, and flooding.

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 or very 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 and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandy. General term for the textural classes loamy very fine sand, loamy fine sand, loamy sand, loamy coarse sand, very fine sand, fine sand, sand, and coarse sand.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell (in tables). 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. General term for the textural classes silt, silt loam, and 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 50 years of 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.

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 slope classes are as follows:

Nearly level	0 to 2 percent
Gently sloping	2 to 6 percent
Sloping	6 to 12 percent
Moderately steep	12 to 20 percent
Steep	20 to 30 percent
Very steep	30 percent and higher

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.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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 material below the solum. 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 if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

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 that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Succession. Replacement of one plant community by another. Shade-tolerant plant species commonly replace shade-intolerant species.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. 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. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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 that is too thin for the specified use.

Tiers. Terms used to define the layers making up the control section in the classification 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.

Toeslope. The position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded 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.

Windthrow. The uprooting and tipping over of trees by the wind.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1951-88 at Cumberland, Wisconsin)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	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----	20.0	-0.5	9.8	42	-33	0	1.05	0.39	1.59	3	10.9
February---	27.2	4.5	15.8	48	-28	0	.87	.27	1.36	2	8.1
March------	38.5	16.7	27.6	64	-18	2	1.81	.87	2.62	4	11.4
April------	56.4	32.5	44.4	83	10	55	2.73	1.49	3.96	5	3.3
May--------	69.9	44.7	57.3	89	27	257	3.56	2.02	4.93	7	.2
June-------	78.0	54.2	66.1	93	38	481	4.51	2.61	6.21	7	.0
July-------	82.7	59.5	71.1	95	46	654	4.20	2.50	5.71	6	.0
August-----	79.9	57.1	68.5	93	42	573	4.66	2.58	6.50	7	.0
September--	69.7	47.9	58.8	89	30	278	3.94	1.86	5.73	6	.0
October----	58.2	37.2	47.7	80	18	82	2.44	1.00	3.65	5	.6
November---	39.5	23.3	31.4	63	-5	3	1.76	.74	2.62	4	6.1
December---	25.2	8.1	16.6	47	-24	0	1.34	.60	1.98	4	11.0
Yearly:											
Average---	53.8	32.1	42.9	---	---	---	---	---	---	---	---
Extreme---	103	-40	---	96	-34	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,384	32.87	27.11	38.27	60	51.4

* 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 1951-88 at Cumberland, 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. 27	May 7	May 21
2 years in 10 later than--	Apr. 23	May 3	May 17
5 years in 10 later than--	Apr. 16	Apr. 25	May 8
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 11	Sept. 29	Sept. 18
2 years in 10 earlier than--	Oct. 16	Oct. 4	Sept. 22
5 years in 10 earlier than--	Oct. 26	Oct. 14	Sept. 30

Table 3.--Growing Season

(Recorded in the period 1951-88 at Cumberland, 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	174	151	124
8 years in 10	180	158	131
5 years in 10	192	171	144
2 years in 10	204	184	157
1 year in 10	211	191	164

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
Ad	Adolph silt loam, 0 to 2 percent slopes	1,294	0.2
AfA	Aftad fine sandy loam, 0 to 3 percent slopes	1,508	0.3
AhA	Almena silt loam, 0 to 3 percent slopes	4,629	0.8
AlD	Amery sandy loam, 12 to 25 percent slopes	5,082	0.9
AmD	Amery-Greenwood complex, 0 to 35 percent slopes	6,676	1.2
AnA	Anigon silt loam, 0 to 2 percent slopes	20,769	3.6
AnB	Anigon silt loam, 2 to 6 percent slopes	30,845	5.4
AnC2	Anigon silt loam, 6 to 12 percent slopes, eroded	6,320	1.1
ApB	Arland fine sandy loam, 2 to 6 percent slopes	6,535	1.1
ApC2	Arland fine sandy loam, 6 to 12 percent slopes, eroded	11,066	1.9
ApD	Arland fine sandy loam, 12 to 25 percent slopes	5,404	0.9
AsB	Arland silt loam, 2 to 6 percent slopes	7,128	1.3
AsC2	Arland silt loam, 6 to 12 percent slopes, eroded	5,610	1.0
Au	Auburndale silt loam, 0 to 2 percent slopes	747	0.1
Ba	Barronett silt loam, 0 to 2 percent slopes	1,716	0.3
Be	Beseman peat, 0 to 1 percent slopes	805	0.1
BpA	Brill silt loam, 0 to 3 percent slopes	7,856	1.4
CaC2	Campia silt loam, 6 to 12 percent slopes, eroded	464	0.1
Cb	Capitola muck, 0 to 2 percent slopes	1,177	0.2
CkA	Chetek sandy loam, 0 to 2 percent slopes	11,443	2.0
CkB	Chetek sandy loam, 2 to 6 percent slopes	21,769	3.8
CkC2	Chetek sandy loam, 6 to 12 percent slopes, eroded	15,170	2.7
ClD	Chetek-Rosholt complex, 12 to 25 percent slopes	9,902	1.7
Cm	Comstock silt loam, 0 to 2 percent slopes	2,229	0.4
CsC	Cress-Mahtomedi complex, 6 to 15 percent slopes	3,675	0.6
CsD	Cress-Mahtomedi complex, 15 to 25 percent slopes	4,592	0.8
CuA	Crystal Lake silt loam, 0 to 2 percent slopes	2,089	0.4
CuB	Crystal Lake silt loam, 2 to 6 percent slopes	2,880	0.5
DoB	Dobie silt loam, 2 to 6 percent slopes	1,739	0.3
DoC2	Dobie silt loam, 6 to 12 percent slopes, eroded	2,077	0.4
DoD2	Dobie silt loam, 12 to 20 percent slopes, eroded	244	*
DrB	Doritty silt loam, 2 to 6 percent slopes	3,201	0.6
Fm	Fordum silt loam, 0 to 2 percent slopes	8,563	1.5
FnB	Freeon silt loam, 2 to 6 percent slopes	72,099	12.7
FnC2	Freeon silt loam, 6 to 12 percent slopes, eroded	8,504	1.5
FrA	Friendship loamy sand, 0 to 3 percent slopes	945	0.2
Gr	Greenwood peat, 0 to 1 percent slopes	6,029	1.1
HaB	Haugen sandy loam, 2 to 6 percent slopes	3,313	0.6
HaC	Haugen sandy loam, 6 to 12 percent slopes	19,437	3.4
HgC	Haugen-Greenwood complex, 0 to 15 percent slopes	26,525	4.7
HvC2	Hayriver fine sandy loam, 6 to 12 percent slopes, eroded	7,699	1.4
HvD	Hayriver fine sandy loam, 12 to 20 percent slopes	5,680	1.0
HyB	Hayriver loam, 2 to 6 percent slopes	3,623	0.6
HzF	Hayriver-Twinmound complex, 20 to 50 percent slopes	9,389	1.6
MaB	Magnor silt loam, 0 to 4 percent slopes	22,447	3.9
Me	Markey muck, 0 to 1 percent slopes	2,154	0.4
Mh	Meehan loamy sand, 0 to 2 percent slopes	332	0.1
MnA	Menahga loamy sand, 0 to 2 percent slopes	994	0.2
MnB	Menahga loamy sand, 2 to 6 percent slopes	12,335	2.2
MnC	Menahga loamy sand, 6 to 12 percent slopes	2,880	0.5
MnD	Menahga loamy sand, 12 to 25 percent slopes	661	0.1
Mo	Moppet fine sandy loam, 0 to 2 percent slopes	1,557	0.3
NeB	Newood sandy loam, 2 to 6 percent slopes	1,368	0.2
NeC	Newood sandy loam, 6 to 15 percent slopes	5,759	1.0
NoD	Newot sandy loam, 15 to 35 percent slopes	1,760	0.3
Ns	Newson loamy sand, 0 to 2 percent slopes	1,307	0.2
Oe	Oesterle sandy loam, 0 to 2 percent slopes	2,420	0.4
OsC2	Otterholt silt loam, 6 to 12 percent slopes, eroded	801	0.1
OsD	Otterholt silt loam, 12 to 20 percent slopes	323	0.1
Pc	Pits, gravel	1,004	0.2
PdB	Plainbo loamy sand, 2 to 6 percent slopes	255	*
PdC	Plainbo loamy sand, 6 to 12 percent slopes	543	0.1

See footnote at end of table.

Table 4.--Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
PdD	Plainbo loamy sand, 12 to 20 percent slopes	327	0.1
Px	Poskin silt loam, 0 to 2 percent slopes	3,532	0.6
QuA	Quarderer silt loam, 0 to 3 percent slopes	1,753	0.3
Rb	Rib silt loam, 0 to 2 percent slopes	5,310	0.9
RhC	Ribhill cobbly silt loam, 2 to 15 percent slopes, very stony	5,171	0.9
RhE	Ribhill cobbly silt loam, 15 to 40 percent slopes, very stony	1,581	0.3
RoA	Rosholt loam, 0 to 2 percent slopes	10,435	1.8
RoB	Rosholt loam, 2 to 6 percent slopes	16,509	2.9
RoC2	Rosholt loam, 6 to 12 percent slopes, eroded	2,286	0.4
Ru	Rubble land	97	*
SaB	Santiago silt loam, 2 to 6 percent slopes	8,563	1.5
SaC2	Santiago silt loam, 6 to 12 percent slopes, eroded	7,609	1.3
SaD2	Santiago silt loam, 12 to 20 percent slopes, eroded	629	0.1
ScA	Scoba sandy loam, 0 to 3 percent slopes	3,042	0.5
Sm	Seelyeville and Cathro mucks, 0 to 1 percent slopes	14,334	2.5
SoA	Siouxcreek silt loam, 0 to 3 percent slopes	597	0.1
SrB	Spencer silt loam, 2 to 6 percent slopes	26,485	4.7
SrC2	Spencer silt loam, 6 to 12 percent slopes, eroded	1,048	0.2
Ud	Udorthents, nearly level	246	*
Va	Vancecreek silt loam, 0 to 2 percent slopes	1,076	0.2
WkC2	Wickware silt loam, 6 to 12 percent slopes, eroded	1,759	0.3
WkD2	Wickware silt loam, 12 to 20 percent slopes, eroded	202	*
	Water	19,259	3.4
	Total	569,197	100.0

* Less than 0.05 percent. The combined extent of the soils assigned an asterisk in the "Percent" column is about 0.3 percent of the survey area.

Table 5.--Land Capability and Yields per Acre of Nonirrigated Crops and Pasture

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
Ad--- Adolph	VIw	---	---	---	---	---	---
AfA--- Aftad	I	100	15	75	3.8	---	3.4
AhA--- Almena	IIw	95	15	78	4.3	4.0	4.3
AlD--- Amery	IVe	70	11	50	3.4	---	2.6
AmD--- Amery-Greenwood	VIIe	---	---	---	---	---	---
AnA--- Anigon	IIs	95	15	85	4.2	---	3.9
AnB--- Anigon	IIe	90	14	80	4.0	---	3.2
AnC2--- Anigon	IIIe	75	12	65	3.6	---	2.5
ApB--- Arland	IIe	85	14	65	4.0	---	3.2
ApC2--- Arland	IIIe	80	13	60	3.6	---	2.8
ApD--- Arland	IVe	75	12	55	3.4	---	2.6
AsB--- Arland	IIe	90	15	70	4.0	---	3.2
AsC2--- Arland	IIIe	80	13	60	3.6	---	2.8
Au--- Auburndale	VIw	---	---	---	---	---	2.3
Ba--- Barronett	IIIw	90	15	---	---	3.5	2.7
Be--- Beseman	VIIw	---	---	---	---	---	---
BpA--- Brill	IIs	90	15	80	4.2	---	4.1
CaC2--- Campia	IIIe	95	15	70	4.8	---	3.9
Cb--- Capitola	VIw	---	---	---	---	---	---

See footnote at end of table.

Table 5.--Land Capability and Yields per Acre of Nonirrigated Crops and Pasture--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
CkA---------- Chetek	IIIs	70	11	60	3.2	---	2.7
CkB---------- Chetek	IIIe	70	11	60	3.2	---	2.7
CkC2---------- Chetek	IVe	60	10	50	2.8	---	2.3
ClD---------- Chetek-Rosholt	VIe	53	8	42	2.7	---	1.9
Cm---------- Comstock	IIw	90	15	70	4.5	4.0	4.1
CsC---------- Cress-Mahtomedi	VIs	---	---	---	2.5	---	1.9
CsD---------- Cress-Mahtomedi	VIIe	---	---	24	2.3	---	1.4
CuA---------- Crystal Lake	I	105	18	80	5.0	---	4.1
CuB---------- Crystal Lake	IIe	100	17	75	4.8	---	4.0
DoB---------- Dobie	IIe	95	15	75	4.2	---	3.9
DoC2---------- Dobie	IIIe	85	14	70	4.0	---	3.7
DoD2---------- Dobie	IVe	75	12	60	3.6	---	3.3
DrB---------- Doritty	IIe	100	16	75	4.8	---	4.1
Fm---------- Fordum	VIw	---	---	---	---	---	2.0
FnB---------- Freeon	IIe	90	15	75	4.3	---	3.9
FnC2---------- Freeon	IIIe	80	13	65	3.9	---	3.5
FrA---------- Friendship	IVs	55	9	55	2.5	---	1.3
Gr---------- Greenwood	VIIw	---	---	---	---	---	---
HaB---------- Haugen	IIe	85	14	65	4.0	3.0	3.2
HaC---------- Haugen	IIIe	80	13	60	3.8	---	3.0

See footnote at end of table.

Table 5.--Land Capability and Yields per Acre of Nonirrigated Crops and Pasture--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
HgC---------- Haugen-Greenwood	VIs	---	---	---	---	---	---
HvC2---------- Hayriver	IIIe	75	12	65	3.5	---	2.5
HvD---------- Hayriver	IVe	65	10	55	3.0	---	2.1
HyB---------- Hayriver	IIe	90	15	70	3.9	---	2.9
HzF---------- Hayriver-Twinmound	VIIe	---	---	---	---	---	1.0
MaB---------- Magnor	IIw	80	13	70	4.0	3.5	3.7
Me---------- Markey	VIw	---	---	---	---	---	---
Mh---------- Meehan	IVw	55	9	50	2.5	2.5	2.0
MnA, MnB-------- Menahga	IVs	45	7	40	2.3	---	1.2
MnC, MnD-------- Menahga	VIs	---	---	25	1.9	---	1.0
Mo---------- Moppet	IIIw	65	11	60	3.5	3.0	2.6
NeB---------- Newood	IIe	80	13	65	3.5	2.8	2.8
NeC---------- Newood	IIIe	75	12	60	3.3	2.6	2.6
NoD---------- Newot	VIe	---	---	40	2.4	---	1.5
Ns---------- Newson	VIw	---	---	---	---	---	1.0
Oe---------- Oesterle	IIw	80	13	70	4.0	2.9	3.4
OsC2---------- Otterholt	IIIe	90	15	70	4.1	---	3.7
OsD---------- Otterholt	IVe	85	14	65	3.9	---	3.5
Pc. Pits							

See footnote at end of table.

Table 5.--Land Capability and Yields per Acre of Nonirrigated Crops and Pasture--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
PdB--- Plainbo	IVs	45	7	40	2.1	---	1.1
PdC--- Plainbo	VIs	40	6	35	1.9	---	0.9
PdD--- Plainbo	VIIs	---	---	---	---	---	0.6
Px--- Poskin	IIw	85	14	75	3.8	3.5	4.3
QuA--- Quarderer	I	110	18	85	5.0	---	4.3
Rb--- Rib	VIw	---	---	---	---	---	3.3
RhC--- Ribhill	VIIs	---	---	---	---	---	2.0
RhE--- Ribhill	VIIs	---	---	---	---	---	1.5
RoA--- Rosholt	IIs	80	13	70	3.7	---	3.2
RoB--- Rosholt	IIe	80	13	70	3.7	---	3.2
RoC2--- Rosholt	IIIe	75	12	65	3.5	---	3.0
Ru. Rubble land							
SaB--- Santiago	IIe	90	15	75	4.5	---	3.9
SaC2--- Santiago	IIIe	80	13	65	4.1	---	3.5
SaD2--- Santiago	IVe	75	12	60	3.9	---	3.3
ScA--- Scoba	IIs	80	12	70	3.7	---	3.0
Sm. Seelyeville and Cathro							
SoA--- Siouxcreek	IIw	80	13	70	3.5	2.9	3.2
SrB--- Spencer	IIe	100	16	80	4.5	---	4.1
SrC2--- Spencer	IIIe	90	15	70	4.1	---	3.7

See footnote at end of table.

Table 5.--Land Capability and Yields per Acre of Nonirrigated Crops and Pasture--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
Ud---------- Udorthents	VIIe	---	---	---	---	---	---
Va---------- Vancecreek	VIw	---	---	---	---	---	2.8
WkC2---------- Wickware	IIIe	100	16	70	4.4	---	4.1
WkD2---------- Wickware	IVe	90	15	60	4.1	---	3.9

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Table 6.--Land Capability and Yields per Acre of Irrigated Vegetable Crops

(Only the soils that are used for vegetable crops are listed. Yields are those that can be expected under a high level of management)

Soil name and map symbol	Land capability	Sweet corn	Irish potatoes	Snap beans	Canning peas
		Tons	Cwt	Lbs	Lbs
AnA---------- Anigon	I	6.5	450	8,500	4,000
AnB---------- Anigon	IIe	6.5	425	8,500	4,000
BpA---------- Brill	I	6.5	450	8,500	4,000
CkA---------- Chetek	IIs	6.0	425	8,250	3,500
CkB---------- Chetek	IIe	5.5	400	8,000	3,000
FrA---------- Friendship	IIs	5.5	400	8,000	2,600
MnA---------- Menahga	IIs	5.5	400	8,000	2,600
MnB---------- Menahga	IIIe	5.5	400	8,000	2,600
Oe---------- Oesterle	IIw	6.0	425	8,500	4,000
Px---------- Poskin	IIw	6.5	450	8,500	4,000
RoA---------- Rosholt	I	6.5	450	8,500	4,000
RoB---------- Rosholt	IIe	6.5	450	8,500	4,000
ScA---------- Scoba	I	6.5	450	8,500	4,000

Table 7.--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
Ad	Adolph silt loam, 0 to 2 percent slopes (where drained)
AfA	Aftad fine sandy loam, 0 to 3 percent slopes
AhA	Almena silt loam, 0 to 3 percent slopes (where drained)
AnA	Anigon silt loam, 0 to 2 percent slopes
AnB	Anigon silt loam, 2 to 6 percent slopes
ApB	Arland fine sandy loam, 2 to 6 percent slopes
AsB	Arland silt loam, 2 to 6 percent slopes
Au	Auburndale silt loam, 0 to 2 percent slopes (where drained)
Ba	Barronett silt loam, 0 to 2 percent slopes (where drained)
BpA	Brill silt loam, 0 to 3 percent slopes
Cb	Capitola muck, 0 to 2 percent slopes (where drained)
Cm	Comstock silt loam, 0 to 2 percent slopes (where drained)
CuA	Crystal Lake silt loam, 0 to 2 percent slopes
CuB	Crystal Lake silt loam, 2 to 6 percent slopes
DoB	Dobie silt loam, 2 to 6 percent slopes
DrB	Doritty silt loam, 2 to 6 percent slopes
FnB	Freeon silt loam, 2 to 6 percent slopes
HaB	Haugen sandy loam, 2 to 6 percent slopes
HyB	Hayriver loam, 2 to 6 percent slopes
MaB	Magnor silt loam, 0 to 4 percent slopes (where drained)
NeB	Newood sandy loam, 2 to 6 percent slopes
Oe	Oesterle sandy loam, 0 to 2 percent slopes (where drained)
Px	Poskin silt loam, 0 to 2 percent slopes (where drained)
QuA	Quarderer silt loam, 0 to 3 percent slopes
Rb	Rib silt loam, 0 to 2 percent slopes (where drained)
RoA	Rosholt loam, 0 to 2 percent slopes
RoB	Rosholt loam, 2 to 6 percent slopes
SaB	Santiago silt loam, 2 to 6 percent slopes
ScA	Scoba sandy loam, 0 to 3 percent slopes
SoA	Siouxcreek silt loam, 0 to 3 percent slopes (where drained)
SrB	Spencer silt loam, 2 to 6 percent slopes
Va	Vancecreek silt loam, 0 to 2 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)

Table 8.--Woodland Management and Productivity

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume*	
Ad---------- Adolph	2W	Slight	Severe	Severe	Severe	Black ash----------	38	23	Black spruce.
						Black spruce--------	26	36	
						Red maple----------	40	22	
AfA---------- Aftad	3L	Slight	Slight	Slight	Severe	Sugar maple---------	60	38	Red pine, eastern white pine, white spruce.
						American basswood---	---	---	
						Yellow birch--------	---	---	
						Red maple----------	---	---	
						Northern red oak----	---	---	
						Quaking aspen-------	---	---	
						White ash----------	---	---	
AhA---------- Almena	3W	Slight	Slight	Moderate	Severe	Sugar maple---------	64	40	White spruce, red pine, eastern white pine, red maple, black spruce.
						American basswood---	68	63	
						Red maple----------	63	39	
						Quaking aspen-------	---	---	
AlD---------- Amery	4R	Moderate	Moderate	Slight	Severe	Northern red oak----	64	57	Red pine, eastern white pine, white spruce, jack pine.
						Quaking aspen-------	---	---	
						White oak----------	---	---	
						White ash----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						Northern pin oak----	---	---	
						Bigtooth aspen------	---	---	
						American elm--------	---	---	
						Yellow birch--------	---	---	
						Black cherry--------	---	---	
AmD: Amery----------	4R	Moderate	Moderate	Slight	Severe	Northern red oak----	64	57	Red pine, eastern white pine, white spruce, jack pine.
						Quaking aspen-------	---	---	
						White oak----------	---	---	
						White ash----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						Northern pin oak----	---	---	
						Bigtooth aspen------	---	---	
						American elm--------	---	---	
						Yellow birch--------	---	---	
						Black cherry--------	---	---	
Greenwood------	2W	Slight	Severe	Severe	Severe	Black spruce--------	15	23	---
						Balsam fir----------	39	69	
						Tamarack-----------	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume*	
AnA, AnB, AnC2--Anigon	3L	Slight	Slight	Slight	Severe	Sugar maple	66	41	Eastern white pine, red pine, white spruce.
						American basswood	69	64	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						Yellow birch	71	44	
						White ash	74	72	
						Bigtooth aspen	---	---	
						Quaking aspen	---	---	
						Black cherry	---	---	
						American elm	---	---	
						Red pine	---	---	
ApB, ApC2--Arland	4A	Slight	Slight	Slight	Moderate	Northern red oak	65	59	Red pine, eastern white pine, white spruce.
						White oak	---	---	
						Red maple	---	---	
						Sugar maple	---	---	
ApD--Arland	4R	Moderate	Moderate	Slight	Moderate	Northern red oak	65	59	Red pine, eastern white pine, white spruce.
						White oak	---	---	
						Red maple	---	---	
						Sugar maple	---	---	
AsB, AsC2--Arland	4A	Slight	Slight	Slight	Moderate	Northern red oak	65	59	Red pine, eastern white pine, white spruce.
						White oak	---	---	
						Red maple	---	---	
						Sugar maple	---	---	
Au--Auburndale	2W	Slight	Severe	Severe	Severe	Red maple	55	35	White spruce, black spruce, cottonwood.
						American basswood	---	---	
						American elm	---	---	
						Balsam fir	54	107	
						Black ash	45	30	
						Quaking aspen	---	---	
Ba--Barronett	2W	Slight	Severe	Severe	Severe	Tamarack	40	27	White spruce, black spruce.
						Black ash	---	---	
						Quaking aspen	---	---	
						American elm	---	---	
						Willow	---	---	
Be--Beseman	3W	Slight	Severe	Severe	Severe	Black spruce	35	35	Black spruce, tamarack.
						Tamarack	50	23	
BpA--Brill	3L	Slight	Slight	Slight	Severe	Sugar maple	62	39	White spruce, eastern white pine, red pine.
						Yellow birch	71	44	
						American basswood	69	64	
						White ash	74	72	
						Northern red oak	---	---	
						Eastern white pine	---	---	
						Bigtooth aspen	---	---	
						American elm	---	---	
						Red maple	---	---	
						White spruce	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume*	
CaC2---------- Campia	3L	Slight	Slight	Slight	Severe	Sugar maple--------- Northern red oak---- White ash---------- American basswood--- Bigtooth aspen------ American elm--------	62 65 --- 71 --- ---	39 59 --- 67 --- ---	Eastern white pine, red pine, white spruce.
Cb---------- Capitola	7W	Slight	Severe	Severe	Severe	Balsam fir---------- Red maple---------- Black ash---------- Quaking aspen------- Northern whitecedar- Tamarack---------- American elm-------- Eastern hemlock-----	52 56 48 --- --- --- --- ---	100 36 31 --- --- --- --- ---	Balsam fir, red maple, white ash, black spruce, white spruce.
CkA, CkB, CkC2-- Chetek	6A	Slight	Slight	Slight	Moderate	Jack pine---------- Northern pin oak---- Black oak---------- Eastern white pine--	57 53 --- ---	80 36 --- ---	Red pine, jack pine, eastern white pine.
ClD: Chetek---------	6R	Moderate	Moderate	Slight	Moderate	Jack pine---------- Northern pin oak---- Black oak---------- Eastern white pine--	57 53 --- ---	80 36 --- ---	Red pine, jack pine, eastern white pine.
Rosholt--------	3R	Moderate	Moderate	Slight	Moderate	Sugar maple--------- White ash---------- American basswood--- Northern red oak----	65 77 --- 69	40 76 --- 64	Red pine, eastern white pine.
Cm---------- Comstock	3W	Slight	Slight	Moderate	Severe	Red maple---------- Sugar maple--------- Balsam fir---------- Quaking aspen------- White ash---------- Paper birch--------- Yellow birch-------- American hornbeam--- American basswood--- American elm--------	61 65 --- --- --- --- --- --- --- ---	38 40 --- --- --- --- --- --- --- ---	Eastern white pine, white spruce, red pine.
CsC: Cress----------	8S	Slight	Moderate	Slight	Moderate	Red pine---------- Quaking aspen------- Paper birch--------- Northern red oak---- Jack pine---------- Balsam fir---------- American basswood--- Eastern white pine-- Bigtooth aspen------ Sugar maple---------	65 78 68 68 68 59 72 55 79 60	117 91 78 63 100 116 69 106 93 38	Red pine, jack pine, eastern white pine.

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume*	
CsC:									
Mahtomedi	8S	Slight	Moderate	Slight	Slight	Red pine	64	112	Red pine, jack pine, eastern white pine, white spruce.
						Jack pine	69	102	
						Eastern white pine	59	118	
						Bigtooth aspen	77	90	
CsD:									
Cress	8R	Moderate	Moderate	Slight	Moderate	Red pine	65	117	Red pine, jack pine, eastern white pine.
						Quaking aspen	78	91	
						Paper birch	68	78	
						Northern red oak	68	63	
						Jack pine	68	100	
						Balsam fir	59	116	
						American basswood	72	69	
						Eastern white pine	55	106	
						Bigtooth aspen	79	93	
						Sugar maple	60	38	
Mahtomedi	8R	Moderate	Moderate	Slight	Slight	Red pine	64	112	Red pine, jack pine, eastern white pine, white spruce.
						Jack pine	69	102	
						Eastern white pine	59	118	
						Bigtooth aspen	77	90	
CuA, CuB Crystal Lake	3L	Slight	Slight	Slight	Severe	Sugar maple	61	38	Eastern white pine, red pine, white spruce.
						American basswood	69	64	
						Yellow birch	---	---	
						Quaking aspen	---	---	
						Bigtooth aspen	---	---	
						American elm	---	---	
						White ash	71	67	
						Black cherry	---	---	
DoB, DoC2 Dobie	4L	Slight	Slight	Moderate	Severe	Northern red oak	65	59	Eastern white pine, red pine.
						White oak	---	---	
						Sugar maple	---	---	
						Basswood	---	---	
DoD2 Dobie	4R	Moderate	Slight	Moderate	Severe	Northern red oak	65	59	Eastern white pine, red pine.
						White oak	---	---	
						Sugar maple	---	---	
						Basswood	---	---	
DrB Doritty	5L	Slight	Slight	Slight	Severe	Northern red oak	75	73	Red pine, eastern white pine, white spruce.
						Sugar maple	---	---	
						White oak	---	---	
						Basswood	---	---	
Fm Fordum	2W	Slight	Severe	Severe	Severe	Silver maple	80	34	Silver maple, red maple, white ash.
						Red maple	---	---	
						White ash	---	---	
						Northern whitecedar	---	---	
						Tamarack	---	---	
						Black spruce	---	---	
						Balsam fir	---	---	
						White spruce	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume*	
FnB, FnC2--------- Freeon	3L	Slight	Slight	Slight	Severe	Sugar maple---------- Northern red oak---- American basswood--- Red maple---------- White oak---------- Quaking aspen------- Bigtooth aspen------ White ash----------	62 63 --- --- --- --- --- ---	39 56 --- --- --- --- --- ---	Red pine, eastern white pine, white spruce.
FrA--------- Friendship	6S	Slight	Moderate	Slight	Slight	Jack pine---------- Red pine---------- Eastern white pine-- Northern pin oak----	56 52 --- ---	78 80 --- ---	Red pine, eastern white pine, jack pine.
Gr--------- Greenwood	2W	Slight	Severe	Severe	Severe	Black spruce-------- Balsam fir---------- Tamarack----------	15 39 ---	23 69 ---	---
HaB, HaC--------- Haugen	3L	Slight	Slight	Slight	Severe	Sugar maple---------- Northern red oak---- Quaking aspen------- Bigtooth aspen------ American elm-------- Yellow birch-------- White ash---------- American basswood--- Black cherry--------	63 --- --- --- --- --- --- --- ---	39 --- --- --- --- --- --- --- ---	Red pine, eastern white pine, white spruce.
HgC: Haugen--------- Greenwood------	3L 2W	Slight Slight	Slight Severe	Slight Severe	Severe Severe	Sugar maple---------- Northern red oak---- Quaking aspen------- Bigtooth aspen------ American elm-------- Yellow birch-------- White ash---------- American basswood--- Black cherry-------- Black spruce-------- Balsam fir---------- Tamarack----------	63 --- --- --- --- --- --- --- --- 15 39 ---	39 --- --- --- --- --- --- --- --- 23 69 ---	Red pine, eastern white pine, white spruce. ---
HvC2--------- Hayriver	4A	Slight	Slight	Slight	Moderate	Northern red oak---- White oak---------- Black oak----------	65 --- ---	59 --- ---	Red pine, eastern white pine.
HvD--------- Hayriver	4R	Moderate	Moderate	Slight	Moderate	Northern red oak---- White oak---------- Black oak----------	65 --- ---	59 --- ---	Red pine, eastern white pine.
HyB--------- Hayriver	4A	Slight	Slight	Slight	Moderate	Northern red oak---- White oak---------- Black oak----------	65 --- ---	59 --- ---	Red pine, eastern white pine.

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume*	
HzF:									
Hayriver	4R	Severe	Moderate	Slight	Moderate	Northern red oak	65	59	Red pine, eastern white pine.
						White oak	---	---	
						Black oak	---	---	
Twinmound	4R	Moderate	Moderate	Moderate	Slight	Jack pine	49	65	Jack pine, red pine.
						Northern pin oak	44	26	
						Quaking aspen	---	---	
						White oak	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
						Eastern white pine	---	---	
MaB	3W	Slight	Slight	Moderate	Severe	Sugar maple	61	38	Eastern white pine, white spruce, red pine.
Magnor						Red maple	65	40	
						Northern red oak	67	61	
						American basswood	67	61	
						Yellow birch	---	---	
						White ash	68	63	
						Quaking aspen	---	---	
						American hornbeam	---	---	
						Balsam fir	---	---	
Me	2W	Slight	Severe	Severe	Severe	Quaking aspen	45	32	---
Markey						Balsam fir	---	---	
						Black spruce	---	---	
						Tamarack	---	---	
						Black ash	---	---	
						Northern whitecedar	---	---	
						Paper birch	---	---	
						Red maple	---	---	
						White spruce	---	---	
Mh	5W	Slight	Moderate	Moderate	Severe	Jack pine	55	77	Jack pine, eastern white pine, red pine, balsam fir, white spruce, red maple.
Meehan						Eastern white pine	62	127	
						Northern pin oak	60	43	
						Red pine	50	75	
						Paper birch	---	---	
						Quaking aspen	---	---	
						Balsam fir	---	---	
						White spruce	---	---	
						Black spruce	---	---	
MnA, MnB, MnC	7S	Slight	Moderate	Slight	Slight	Jack pine	65	94	Red pine, white spruce, eastern white pine, jack pine.
Menahga						Red pine	63	109	
						Eastern white pine	57	112	
						Quaking aspen	66	75	
						Bigtooth aspen	76	89	
						Paper birch	60	65	
						Balsam fir	60	118	
						Northern red oak	55	42	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume*	
MnD--Menahga	7R	Moderate	Moderate	Slight	Slight	Jack pine	65	94	Red pine, white spruce, eastern white pine, jack pine.
						Red pine	63	109	
						Eastern white pine	57	112	
						Quaking aspen	66	75	
						Bigtooth aspen	76	89	
						Paper birch	60	65	
						Balsam fir	60	118	
						Northern red oak	55	42	
Mo--Moppet	3L	Slight	Slight	Slight	Severe	Red maple	60	38	White spruce, eastern white pine, red pine, black spruce.
						Northern red oak	---	---	
						American basswood	---	---	
						White ash	---	---	
						White spruce	---	---	
						Eastern white pine	---	---	
NeB, NeC--Newood	3L	Slight	Slight	Slight	Moderate	Sugar maple	59	37	Red pine, eastern white pine, white spruce.
						Red maple	---	---	
						Northern red oak	---	---	
						Eastern hophornbeam	---	---	
						Paper birch	---	---	
						Bigtooth aspen	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						White ash	---	---	
NoD--Newot	3R	Moderate	Slight	Slight	Moderate	Sugar maple	59	37	Red pine, eastern white pine, white spruce.
						Red maple	---	---	
						Northern red oak	---	---	
						Eastern hophornbeam	---	---	
						Paper birch	---	---	
						Bigtooth aspen	---	---	
						Yellow birch	---	---	
						Eastern hemlock	---	---	
						White ash	---	---	
Ns--Newson	6W	Slight	Severe	Severe	Severe	Jack pine	59	84	Eastern white pine, white spruce, balsam fir, tamarack.
						Quaking aspen	50	43	
						Paper birch	---	---	
						Eastern white pine	---	---	
Oe--Oesterle	3W	Slight	Slight	Moderate	Severe	Red maple	66	41	Red maple, white ash, white spruce.
						Northern red oak	72	69	
						Quaking aspen	78	91	
						Balsam fir	---	---	
						Paper birch	---	---	
						Yellow birch	---	---	
OsC2--Otterholt	5L	Slight	Slight	Slight	Severe	Northern red oak	72	44	Eastern white pine, red pine, white spruce.
						Sugar maple	---	---	
						American basswood	---	---	
OsD--Otterholt	5R	Moderate	Slight	Slight	Severe	Northern red oak	72	44	Eastern white pine, red pine, white spruce.
						Sugar maple	---	---	
						American basswood	---	---	

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume*	
PdB, PdC-------- Plainbo	5D	Slight	Slight	Moderate	Slight	Jack pine---------- Northern pin oak---- Black oak----------	55 47 ---	77 30 ---	Jack pine, eastern white pine.
PdD-------- Plainbo	5R	Moderate	Moderate	Moderate	Slight	Jack pine---------- Northern pin oak---- Black oak----------	55 47 ---	77 30 ---	Jack pine, eastern white pine.
Px-------- Poskin	3W	Slight	Slight	Moderate	Severe	Red maple---------- White ash---------- Eastern hemlock-----	65 --- ---	40 --- ---	White spruce, red maple, white ash, black spruce.
QuA-------- Quarderer	5L	Slight	Slight	Slight	Severe	Northern red oak---- Sugar maple--------- White oak---------- Basswood----------	75 --- --- ---	73 --- --- ---	Red pine, eastern white pine, white spruce.
Rb-------- Rib	2W	Slight	Severe	Severe	Severe	Red maple---------- Black ash---------- American elm-------- Silver maple--------	55 --- --- ---	35 --- --- ---	Red maple, white spruce.
RhC-------- Ribhill	4L	Slight	Slight	Moderate	Moderate	Northern red oak---- Sugar maple--------- White ash---------- American basswood---	66 60 --- ---	60 38 --- ---	Red pine, eastern white pine, white spruce.
RhE-------- Ribhill	4R	Moderate	Moderate	Moderate	Moderate	Northern red oak---- Sugar maple--------- White ash---------- American basswood---	66 60 --- ---	60 38 --- ---	Red pine, eastern white pine, white spruce.
RoA, RoB, RoC2-- Rosholt	3L	Slight	Slight	Slight	Moderate	Sugar maple--------- White ash---------- American basswood--- Northern red oak----	65 77 --- 69	40 76 --- 64	Red pine, eastern white pine.
SaB, SaC2------- Santiago	4L	Slight	Slight	Slight	Moderate	Northern red oak---- Sugar maple--------- American basswood--- White ash---------- Red maple---------- Red pine---------- Quaking aspen-------	64 --- --- --- --- --- ---	57 --- --- --- --- --- ---	Red pine, eastern white pine, white spruce.
SaD2-------- Santiago	4R	Moderate	Moderate	Slight	Moderate	Northern red oak---- Sugar maple--------- American basswood--- White ash---------- Red maple---------- Red pine---------- Quaking aspen-------	64 --- --- --- --- --- ---	57 --- --- --- --- --- ---	Red pine, eastern white pine, white spruce.

See footnote at end of table.

Table 8.--Woodland Management and Productivity--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume*	
ScA---------- Scoba	3L	Slight	Slight	Slight	Moderate	Sugar maple--------- Northern red oak---- Yellow birch-------- American basswood--- Red maple---------- Quaking aspen------- Bigtooth aspen------ White ash---------- Eastern white pine-- Black cherry--------	61 65 --- --- --- --- --- --- --- ---	38 59 --- --- --- --- --- --- --- ---	Eastern white pine, red pine, white spruce, black spruce.
Sm:									
Seelyeville----	3W	Slight	Severe	Severe	Severe	Black spruce-------- Tamarack---------- Black ash---------- Northern whitecedar- Balsam fir----------	34 56 55 30 45	45 22 35 42 83	Black spruce, tamarack, northern whitecedar, balsam fir.
Cathro---------	7W	Slight	Severe	Severe	Severe	Balsam fir---------- Northern whitecedar- Tamarack---------- Paper birch--------- White spruce--------	53 33 --- --- ---	102 48 --- --- ---	---
SoA---------- Siouxcreek	3W	Slight	Slight	Severe	Severe	Red maple---------- Silver maple-------- White ash---------- Green ash---------- Quaking aspen------- Bigtooth aspen------	60 --- --- --- --- ---	38 --- --- --- --- ---	White spruce, red maple, white ash.
SrB, SrC2------- Spencer	3L	Slight	Slight	Slight	Severe	Sugar maple--------- Northern red oak---- American basswood--- Yellow birch-------- Quaking aspen------- Black cherry-------- American elm--------	63 70 67 --- --- --- ---	39 66 61 --- --- --- ---	Eastern white pine, red pine, white spruce.
Va---------- Vancecreek	2W	Slight	Severe	Severe	Severe	Silver maple-------- Green ash---------- Red maple----------	80 --- ---	34 --- ---	Silver maple, red maple, green ash, white ash.
WkC2---------- Wickware	5L	Slight	Slight	Slight	Severe	Northern red oak---- Sugar maple--------- White oak---------- Basswood----------	75 --- --- ---	73 --- --- ---	Red pine, eastern white pine, white spruce.
WkD2---------- Wickware	5R	Moderate	Moderate	Slight	Severe	Northern red oak---- Sugar maple--------- White oak---------- Basswood----------	75 --- --- ---	73 --- --- ---	Red pine, eastern white pine, white spruce.

* 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 9.--Woodland Equipment Use

(Only the soils suitable for the production of commercial trees are listed)

Soil name and map symbol	Ratings for the most limiting seasons				Preferred operating seasons
	Logging areas and skid trails	Log landings	Haul roads	Site preparation and planting	
Ad--- Adolph	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
AfA--- Aftad	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
AhA--- Almena	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
AlD--- Amery	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Summer, fall, winter.
AmD:					
Amery---	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Summer, fall, winter.
Greenwood---	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
AnA, AnB, AnC2--- Anigon	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
ApB--- Arland	Slight---	Slight---	Slight---	Slight---	Year round.
ApC2--- Arland	Slight---	Moderate: slope.	Slight---	Slight---	Year round.
ApD--- Arland	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
AsB--- Arland	Slight---	Slight---	Slight---	Slight---	Year round.
AsC2--- Arland	Slight---	Moderate: slope.	Slight---	Slight---	Year round.
Au--- Auburndale	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
Ba--- Barronett	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
Be--- Beseman	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
BpA--- Brill	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.

Table 9.--Woodland Equipment Use--Continued

Soil name and map symbol	Ratings for the most limiting seasons				Preferred operating seasons
	Logging areas and skid trails	Log landings	Haul roads	Site preparation and planting	
CaC2---------- Campia	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
Cb---------- Capitola	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
CkA, CkB---------- Chetek	Slight---------	Slight---------	Slight---------	Slight---------	Year round.
CkC2---------- Chetek	Slight---------	Moderate: slope.	Slight---------	Slight---------	Year round.
ClD:					
Chetek----------	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
Rosholt----------	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Summer, fall, winter.
Cm---------- Comstock	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
CsC:					
Cress----------	Slight---------	Moderate: slope.	Slight---------	Slight---------	Year round.
Mahtomedi----------	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: too sandy.	Year round.
CsD:					
Cress----------	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
Mahtomedi----------	Moderate: too sandy, slope.	Severe: slope.	Moderate: slope, too sandy.	Moderate: too sandy, slope.	Year round.
CuA, CuB---------- Crystal Lake	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
DoB, DoC2---------- Dobie	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
DoD2---------- Dobie	Severe: low strength.	Severe: slope, low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
DrB---------- Doritty	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
Fm---------- Fordum	Severe: wetness, low strength.	Severe: wetness, flooding, low strength.	Severe: wetness, flooding, low strength.	Severe: wetness, low strength.	Winter.
FnB---------- Freeon	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.

Table 9.--Woodland Equipment Use--Continued

Soil name and map symbol	Ratings for the most limiting seasons				Preferred operating seasons
	Logging areas and skid trails	Log landings	Haul roads	Site preparation and planting	
FnC2---------- Freeon	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
FrA---------- Friendship	Slight---------	Slight---------	Slight---------	Slight---------	Year round.
Gr---------- Greenwood	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
HaB---------- Haugen	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
HaC---------- Haugen	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
HgC:					
Haugen----------	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
Greenwood----------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
HvC2---------- Hayriver	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
HvD---------- Hayriver	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Summer, fall, winter.
HyB---------- Hayriver	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
HzF:					
Hayriver----------	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Summer, fall, winter.
Twinmound----------	Moderate: too sandy, slope.	Severe: slope.	Moderate: slope, too sandy.	Moderate: too sandy, slope.	Year round.
MaB---------- Magnor	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
Me---------- Markey	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
Mh---------- Meehan	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.
MnA, MnB---------- Menahga	Slight---------	Slight---------	Slight---------	Slight---------	Year round.

Table 9.--Woodland Equipment Use--Continued

Soil name and map symbol	Ratings for the most limiting seasons				Preferred operating seasons
	Logging areas and skid trails	Log landings	Haul roads	Site preparation and planting	
MnC---------- Menahga	Slight---------	Moderate: slope.	Slight---------	Slight---------	Year round.
MnD---------- Menahga	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Year round.
Mo---------- Moppet	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
NeB, NeC---------- Newood	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
NoD---------- Newot	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Summer, fall, winter.
Ns---------- Newson	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.
Oe---------- Oesterle	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
OsC2---------- Otterholt	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
OsD---------- Otterholt	Severe: low strength.	Severe: slope, low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
PdB---------- Plainbo	Slight---------	Slight---------	Slight---------	Slight---------	Year round.
PdC---------- Plainbo	Slight---------	Moderate: slope.	Slight---------	Slight---------	Year round.
PdD---------- Plainbo	Moderate: too sandy, slope.	Severe: slope.	Moderate: slope, too sandy.	Moderate: too sandy, slope.	Year round.
Px---------- Poskin	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Summer, winter.
QuA---------- Quarderer	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
Rb---------- Rib	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
RhC---------- Ribhill	Moderate: low strength.	Moderate: slope, depth to rock, too cobbly.	Moderate: depth to rock, too cobbly.	Moderate: low strength.	Summer, fall, winter.
RhE---------- Ribhill	Moderate: slope, low strength.	Severe: slope.	Moderate: depth to rock, slope, too cobbly.	Moderate: slope, low strength.	Summer, fall, winter.

Table 9.--Woodland Equipment Use--Continued

Soil name and map symbol	Ratings for the most limiting seasons				Preferred operating seasons
	Logging areas and skid trails	Log landings	Haul roads	Site preparation and planting	
RoA, RoB---------- Rosholt	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
RoC2---------- Rosholt	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
Ru---------- Rubble land	Severe: too stony.	Severe: too stony.	Severe: too stony.	Severe: too stony.	Year round.
SaB---------- Santiago	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
SaC2---------- Santiago	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
SaD2---------- Santiago	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Summer, fall, winter.
ScA---------- Scoba	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.
Sm:					
Seelyeville---------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
Cathro----------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter.
SoA---------- Siouxcreek	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.
SrB, SrC2---------- Spencer	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
Va---------- Vancecreek	Severe: wetness, low strength.	Severe: wetness, flooding, low strength.	Severe: wetness, flooding, low strength.	Severe: wetness, low strength.	Winter.
WkC2---------- Wickware	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.
WkD2---------- Wickware	Severe: low strength.	Severe: slope, low strength.	Severe: low strength.	Severe: low strength.	Summer, fall, winter.

Table 10.--Windbreaks and Environmental Plantings

(Only the soils suitable for windbreaks and environmental plantings are listed. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AfA---------- Aftad	---	Northern whitecedar, lilac, American cranberrybush, Amur maple, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red maple, red pine, white ash.	---
AhA---------- Almena	---	Nannyberry viburnum, redosier dogwood, silky dogwood, American cranberrybush, lilac, northern whitecedar.	White spruce------	Silver maple, eastern white pine, red pine, white ash, red maple.	---
AlD---------- Amery	---	Lilac, American cranberrybush, Amur maple, northern whitecedar, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---
AmD: Amery----------	---	Lilac, American cranberrybush, Amur maple, northern whitecedar, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---
Greenwood.					
AnA, AnB, AnC2---- Anigon	Manyflower cotoneaster.	Gray dogwood, American cranberrybush, Amur maple, lilac, northern whitecedar, Siberian peashrub, silky dogwood.	Norway spruce-----	Jack pine, red pine, eastern white pine.	---
ApB, ApC2, ApD, AsB, AsC2-------- Arland	Manyflower cotoneaster.	Northern whitecedar, Amur maple, American cranberrybush, lilac, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---

Table 10.--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
Ba---------- Barronett	---	Northern whitecedar, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood, common ninebark.	White spruce, balsam fir.	Silver maple, red maple, green ash, white ash.	---
BpA---------- Brill	Manyflower cotoneaster.	Silky dogwood, northern whitecedar, Amur maple, lilac, gray dogwood, Siberian peashrub, American cranberrybush.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
CaC2---------- Campia	---	Gray dogwood, lilac, Amur maple, northern whitecedar, redosier dogwood.	Norway spruce, white spruce, Black Hills spruce.	White ash, red maple, red pine, eastern white pine.	---
CkA, CkB, CkC2---- Chetek	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, gray dogwood, silky dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
ClD: Chetek---------- Rosholt----------	Manyflower cotoneaster. Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, gray dogwood, silky dogwood. Lilac, American cranberrybush, Amur maple, northern whitecedar, Siberian peashrub, gray dogwood, silky dogwood.	Norway spruce----- Norway spruce-----	Eastern white pine, red pine, jack pine. Red pine, jack pine, eastern white pine.	--- ---

Table 10.--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
Cm---------- Comstock	---	Nannyberry viburnum, northern whitecedar, lilac, American cranberrybush, silky dogwood, redosier dogwood.	White spruce------	Eastern white pine, red pine, white ash, red maple, silver maple.	---
CsC, CsD: Cress----------	---	Northern whitecedar, Siberian peashrub, lilac, Manchurian crabapple, Siberian crabapple.	Red pine, jack pine, green ash, Russian-olive.	Eastern white pine, Siberian elm.	---
Mahtomedi---------	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, northern whitecedar.	Norway spruce-----	Jack pine, red pine, eastern white pine.	---
CuA, CuB---------- Crystal Lake	---	Gray dogwood, Amur maple, American cranberrybush, lilac, northern whitecedar.	Black Hills spruce, Norway spruce, white spruce.	Eastern white pine, red pine, white ash, red maple.	---
DoB, DoC2, DoD2--- Dobie	Manyflower cotoneaster.	Siberian peashrub, northern whitecedar, lilac, American cranberrybush, silky dogwood, gray dogwood.	Norway spruce, Amur maple.	Eastern white pine, red pine, jack pine.	---
DrB---------- Doritty	---	American cranberrybush, northern whitecedar, Amur maple, lilac, gray dogwood.	Black Hills spruce, white spruce, Norway spruce.	Eastern white pine, red maple, red pine, white ash.	---
FnB, FnC2--------- Freeon	---	Amur maple, lilac, American cranberrybush, northern whitecedar, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---

Table 10.--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
FrA---------- Friendship	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
HaB, HaC---------- Haugen	---	Lilac, American cranberrybush, Amur maple, northern whitecedar, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---
HgC: Haugen----------	---	Lilac, American cranberrybush, Amur maple, northern whitecedar, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, white ash, red maple.	---
Greenwood.					
HvC2, HvD, HyB---- Hayriver	---	Amur maple, silky dogwood, northern whitecedar, American cranberrybush, gray dogwood, lilac, Siberian peashrub, manyflower cotoneaster.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
HzF: Hayriver---------	---	Amur maple, silky dogwood, northern whitecedar, American cranberrybush, gray dogwood, lilac, Siberian peashrub, manyflower cotoneaster.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
Twinmound--------	---	Siberian peashrub, northern whitecedar, lilac, silky dogwood, gray dogwood, Amur maple, American cranberrybush.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---

Table 10.--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
MaB---------- Magnor	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce------	Eastern white pine, red pine, white ash, red maple, silver maple.	---
Mh---------- Meehan	---	Redosier dogwood, silky dogwood, nannyberry viburnum, American cranberrybush, lilac, northern whitecedar.	White spruce------	Red maple, white ash, silver maple, red pine, eastern white pine.	---
MnA, MnB, MnC, MnD---------- Menahga	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, northern whitecedar.	Norway spruce-----	Jack pine, red pine, eastern white pine.	---
Mo---------- Moppet	---	Northern whitecedar, lilac, redosier dogwood, silky dogwood, American cranberrybush, nannyberry viburnum.	White spruce------	Eastern white pine, red pine, white ash, red maple, silver maple.	---
NeB, NeC---------- Newood	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
NoD---------- Newot	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---

Table 10.--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
Oe---------- Oesterle	---	Nannyberry viburnum, American cranberrybush, redosier dogwood, lilac, northern whitecedar, silky dogwood.	White spruce------	Red maple, silver maple, white ash, red pine, eastern white pine.	---
OsC2, OsD--------- Otterholt	---	Gray dogwood, Amur maple, American cranberrybush, lilac, northern whitecedar.	Black Hills spruce, white spruce, Norway spruce.	Eastern white pine, red pine, white ash, red maple.	---
PdB, PdC, PdD----- Plainbo	Manyflower cotoneaster.	Northern whitecedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
Px---------- Poskin	---	Common ninebark, northern whitecedar, lilac, American cranberrybush, silky dogwood, redosier dogwood, nannyberry viburnum.	White spruce------	Eastern white pine, white ash, red maple, silver maple.	---
QuA---------- Quarderer	---	Northern whitecedar, silky dogwood, lilac, nannyberry viburnum, American cranberrybush, redosier dogwood.	White spruce------	Eastern white pine, red maple, red pine, silver maple, white ash.	---
Rb---------- Rib	---	Northern whitecedar, redosier dogwood, American cranberrybush, silky dogwood, common ninebark, nannyberry viburnum.	White spruce, balsam fir.	Red maple, white ash, green ash.	Silver maple.
RoA, RoB, RoC2---- Rosholt	Manyflower cotoneaster.	Lilac, American cranberrybush, Amur maple, northern whitecedar, Siberian peashrub, gray dogwood, silky dogwood.	Norway spruce-----	Red pine, jack pine, eastern white pine.	---

Table 10.--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
SaB, SaC2, SaD2--- Santiago	---	Gray dogwood, Amur maple, American cranberrybush, lilac, northern whitecedar.	Black Hills spruce, Norway spruce, white spruce.	Eastern white pine, red pine, white ash, red maple.	---
ScA--- Scoba	Manyflower cotoneaster.	American cranberrybush, northern whitecedar, Siberian peashrub, lilac, gray dogwood, Amur maple.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
Sm: Seelyeville------ Cathro.	Common ninebark---	---	---	Golden willow, white willow.	Imperial Carolina poplar.
SoA--- Siouxcreek	---	Northern whitecedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce------	Eastern white pine, red pine, white ash, red maple, silver maple.	---
SrB, SrC2--- Spencer	---	Gray dogwood, Amur maple, American cranberrybush, lilac, northern whitecedar.	Norway spruce, Black Hills spruce, white spruce.	Eastern white pine, red pine, red maple, white ash.	---
Va--- Vancecreek	---	Northern whitecedar, silky dogwood, American cranberrybush, redosier dogwood, nannyberry viburnum, common ninebark.	White spruce, balsam fir.	Silver maple, green ash, red maple, white ash.	---
WkC2, WkD2--- Wickware	---	American cranberrybush, northern whitecedar, Amur maple, lilac, gray dogwood.	Black Hills spruce, white spruce, Norway spruce.	Eastern white pine, red maple, red pine, white ash.	---

Table 11.--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
Ad Adolph	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
AfA Aftad	Slight	Slight	Slight	Slight	Slight.
AhA Almena	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
AlD Amery	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
AmD: Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Greenwood	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
AnA Anigon	Slight	Slight	Slight	Severe: erodes easily.	Moderate: large stones.
AnB Anigon	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Moderate: large stones.
AnC2 Anigon	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: large stones, slope.
ApB Arland	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Moderate: depth to rock.
ApC2 Arland	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
ApD Arland	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
AsB Arland	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Moderate: depth to rock.
AsC2 Arland	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
Au Auburndale	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ba Barronett	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Be Beseman	Severe: ponding, excess humus.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.	Severe: too acid, ponding, excess humus.
BpA Brill	Slight	Slight	Slight	Slight	Moderate: large stones.
CaC2 Campia	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Cb Capitola	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
CkA Chetek	Slight	Slight	Moderate: small stones.	Slight	Moderate: large stones, droughty.
CkB Chetek	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones, droughty.
CkC2 Chetek	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
ClD: Chetek	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Rosholt	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Cm Comstock	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
CsC: Cress	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Mahtomedi	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
CsD: Cress	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Mahtomedi	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy.	Severe: slope.
CuA Crystal Lake	Slight	Slight	Slight	Severe: erodes easily.	Slight.
CuB Crystal Lake	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
DoB Dobie	Slight	Slight	Moderate: slope, depth to rock.	Severe: erodes easily.	Moderate: depth to rock.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
DoC2---------- Dobie	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope, depth to rock.
DoD2---------- Dobie	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
DrB---------- Doritty	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Fm---------- Fordum	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
FnB---------- Freeon	Moderate: wetness.	Moderate: wetness.	Moderate: slope, small stones, wetness.	Severe: erodes easily.	Slight.
FnC2---------- Freeon	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
FrA---------- Friendship	Moderate: too sandy.	Moderate: too sandy.	Moderate: small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
Gr---------- Greenwood	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
HaB---------- Haugen	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: large stones.
HaC---------- Haugen	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, slope.
HgC:					
Haugen----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, slope.
Greenwood----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
HvC2---------- Hayriver	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope, depth to rock.
HvD---------- Hayriver	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
HyB---------- Hayriver	Slight----------	Slight----------	Moderate: slope, small stones, depth to rock.	Slight----------	Moderate: depth to rock.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
HzF:					
Hayriver	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Twinmound	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.	Severe: droughty, slope.
MaB--- Magnor	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
Me--- Markey	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Mh--- Meehan	Severe: wetness, too acid.	Severe: too acid.	Severe: wetness, too acid.	Moderate: wetness, too sandy.	Severe: too acid.
MnA--- Menahga	Moderate: too sandy.	Moderate: too sandy.	Moderate: small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
MnB--- Menahga	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
MnC--- Menahga	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
MnD--- Menahga	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: slope.
Mo--- Moppet	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
NeB--- Newood	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Moderate: large stones, droughty.
NeC--- Newood	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
NoD--- Newot	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Ns--- Newson	Severe: flooding, ponding.	Severe: ponding, too acid.	Severe: excess humus, ponding.	Severe: ponding.	Severe: too acid, ponding.
Oe--- Oesterle	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness, droughty.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
OsC2--Otterholt	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: large stones, slope.
OsD--Otterholt	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Pc. Pits					
PdB--Plainbo	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Severe: droughty.
PdC--Plainbo	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Severe: droughty.
PdD--Plainbo	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: droughty, slope.
Px--Poskin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
QuA--Quarderer	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Rb--Rib	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
RhC--Ribhill	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: large stones, slope.	Moderate: large stones.	Severe: large stones.
RhE--Ribhill	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: slope.	Severe: large stones, slope.
RoA--Rosholt	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
RoB--Rosholt	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
RoC2--Rosholt	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Ru. Rubble land					
SaB--Santiago	Slight	Slight	Moderate: slope, small stones.	Severe: erodes easily.	Slight.
SaC2--Santiago	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

Table 11.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SaD2--Santiago	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
ScA--Scoba	Slight	Slight	Moderate: small stones.	Slight	Moderate: large stones, droughty.
Sm:					
Seelyeville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Cathro	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
SoA--Siouxcreek	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, depth to rock.
SrB--Spencer	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Moderate: large stones.
SrC2--Spencer	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: large stones, slope.
Ud--Udorthents	Slight	Slight	Slight	Slight	Slight.
Va--Vancecreek	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
WkC2--Wickware	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
WkD2--Wickware	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.

Table 12.--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
Ad---- Adolph	Very poor.	Very poor.	Good	Poor	Poor	Good	Good	Poor	Poor	Good.
AfA---- Aftad	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AhA---- Almena	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
AlD---- Amery	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AmD:										
Amery----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Greenwood----	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
AnA, AnB---- Anigon	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AnC2---- Anigon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ApB---- Arland	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ApC2---- Arland	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ApD---- Arland	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
AsB---- Arland	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AsC2---- Arland	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Au---- Auburndale	Good	Good	Fair	Fair	Good	Good	Good	Good	Fair	Good.
Ba---- Barronett	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
Be---- Beseman	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Very poor.	Good.
BpA---- Brill	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CaC2---- Campia	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Cb---- Capitola	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

Table 12.--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
CkA, CkB, CkC2----- Chetek	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
ClD:										
Chetek----------	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Rosholt----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Cm---------- Comstock	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
CsC:										
Cress----------	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Mahtomedi---------	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
CsD:										
Cress----------	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Mahtomedi---------	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
CuA, CuB---------- Crystal Lake	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
DoB---------- Dobie	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
DoC2---------- Dobie	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
DoD2---------- Dobie	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
DrB---------- Doritty	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Fm---------- Fordum	Very poor.	Very poor.	Poor	Fair	Fair	Good	Good	Very poor.	Fair	Good.
FnB---------- Freeon	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
FnC2---------- Freeon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FrA---------- Friendship	Poor	Fair	Good	Fair	Good	Poor	Very poor.	Fair	Good	Very poor.
Gr---------- Greenwood	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
HaB---------- Haugen	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

Table 12.--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
HaC---- Haugen	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HgC:										
Haugen----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Greenwood----	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
HvC2---- Hayriver	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
HvD---- Hayriver	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
HyB---- Hayriver	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
HzF:										
Hayriver----	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Twinmound----	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
MaB---- Magnor	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Me---- Markey	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Mh---- Meehan	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
MnA, MnB, MnC---- Menahga	Poor	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
MnD---- Menahga	Very poor.	Poor	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Mo---- Moppet	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
NeB---- Newood	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
NeC---- Newood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NoD---- Newot	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ns---- Newson	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
Oe---- Oesterle	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
OsC2, OsD---- Otterholt	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

Table 12.--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
Pc. Pits										
PdB Plainbo	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
PdC, PdD Plainbo	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Px Poskin	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
QuA Quarderer	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Rb Rib	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
RhC, RhE Ribhill	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
RoA, RoB Rosholt	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RoC2 Rosholt	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ru. Rubble land										
SaB Santiago	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SaC2, SaD2 Santiago	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ScA Scoba	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Sm: Seelyeville	Very poor.	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good.
Cathro	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
SoA Siouxcreek	Fair	Good	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
SrB Spencer	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SrC2 Spencer	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ud. Udorthents										
Va Vancecreek	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Poor	Good.

Table 12.--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
WkC2---------- Wickware	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WkD2---------- Wickware	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

Table 13.--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
Ad Adolph	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
AfA Aftad	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Slight.
AhA Almena	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: large stones, wetness.
AlD Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AmD: Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Greenwood	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
AnA Anigon	Severe: cutbanks cave.	Slight	Slight	Slight	Severe: frost action.	Moderate: large stones.
AnB Anigon	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Severe: frost action.	Moderate: large stones.
AnC2 Anigon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: large stones, slope.
ApB Arland	Slight	Slight	Slight	Moderate: slope.	Slight	Moderate: depth to rock.
ApC2 Arland	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, depth to rock.
ApD Arland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AsB Arland	Slight	Slight	Slight	Moderate: slope.	Slight	Moderate: depth to rock.
AsC2 Arland	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, depth to rock.
Au Auburndale	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.

Table 13.--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
Ba Barronett	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding.	Severe: ponding.
Be Beseman	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: too acid, ponding, excess humus.
BpA Brill	Severe: cutbanks cave.	Slight	Slight	Slight	Severe: frost action.	Moderate: large stones.
CaC2 Campia	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Cb Capitola	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
CkA Chetek	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones, droughty.
CkB Chetek	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones, droughty.
CkC2 Chetek	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
ClD:						
Chetek	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rosholt	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cm Comstock	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
CsC:						
Cress	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Mahtomedi	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
CsD:						
Cress	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mahtomedi	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 13.--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
CuA---------- Crystal Lake	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
CuB---------- Crystal Lake	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
DoB---------- Dobie	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: frost action.	Moderate: depth to rock.
DoC2--------- Dobie	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope, depth to rock.
DoD2--------- Dobie	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
DrB---------- Doritty	Moderate: wetness.	Slight---------	Moderate: wetness.	Moderate: slope.	Severe: low strength, frost action.	Slight.
Fm---------- 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: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Slight.
FnC2--------- Freeon	Severe: cutbanks cave, wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope, frost action.	Moderate: slope.
FrA---------- Friendship	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.
Gr---------- Greenwood	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
HaB---------- Haugen	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
HaC---------- Haugen	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
HgC:						
Haugen----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
Greenwood--------	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, excess humus.	Severe: ponding, excess humus.

Table 13.--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
HvC2--Hayriver	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, depth to rock.
HvD--Hayriver	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HyB--Hayriver	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: depth to rock.
HzF:						
Hayriver	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Twinmound	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
MaB--Magnor	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.
Me--Markey	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Mh--Meehan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Severe: too acid.
MnA--Menahga	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
MnB--Menahga	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
MnC--Menahga	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
MnD--Menahga	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mo--Moppet	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
NeB--Newood	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Moderate: large stones, droughty.
NeC--Newood	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
NoD--Newot	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 13.--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
Ns Newson	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding.
Oe Oesterle	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness, droughty.
OsC2 Otterholt	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: large stones, slope.
OsD Otterholt	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
Pc. Pits						
PdB Plainbo	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
PdC Plainbo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
PdD Plainbo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Px Poskin	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
QuA Quarderer	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Rb Rib	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding.
RhC 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.
RhE 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.
RoA Rosholt	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
RoB Rosholt	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
RoC2 Rosholt	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.

Table 13.--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
Ru. Rubble land						
SaB---------- Santiago	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
SaC2---------- Santiago	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
SaD2---------- Santiago	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ScA---------- Scoba	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: large stones, droughty.
Sm:						
Seelyeville------	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Cathro----------	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
SoA---------- Siouxcreek	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, depth to rock.
SrB---------- Spencer	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Moderate: large stones.
SrC2---------- Spencer	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: large stones, slope.
Ud---------- Udorthents	Severe: cutbanks cave.	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Slight.
Va---------- Vancecreek	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
WkC2---------- Wickware	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
WkD2---------- Wickware	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.

Table 14.--Sanitary Facilities

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ad Adolph	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
AfA Aftad	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
AhA Almena	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
AlD Amery	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
AmD: Amery	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Greenwood	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
AnA, AnB Anigon	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
AnC2 Anigon	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ApB Arland	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
ApC2 Arland	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
ApD Arland	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope.
AsB Arland	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.

Table 14.--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
AsC2---------- Arland	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
Au---------- Auburndale	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Ba---------- Barronett	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too sandy.	Severe: ponding.	Poor: ponding.
Be---------- Beseman	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus, too acid.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
BpA---------- Brill	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
CaC2---------- Campia	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, thin layer.
Cb---------- Capitola	Severe: ponding, percs slowly.	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: seepage, small stones, ponding.
CkA, CkB---------- Chetek	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
CkC2---------- Chetek	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ClD: Chetek---------- Rosholt----------	Severe: poor filter, slope. Severe: poor filter, slope.	Severe: seepage, slope. Severe: seepage, slope.	Severe: seepage, slope, too sandy. Severe: seepage, slope, too sandy.	Severe: seepage, slope. Severe: seepage, slope.	Poor: seepage, too sandy, small stones. Poor: seepage, too sandy, small stones.
Cm---------- Comstock	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.

Table 14.--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
CsC:					
Cress	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Mahtomedi	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
CsD:					
Cress	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Mahtomedi	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
CuA, CuB Crystal Lake	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too sandy.	Moderate: wetness.	Poor: too sandy.
DoB Dobie	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
DoC2 Dobie	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
DoD2 Dobie	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
DrB Doritty	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
Fm Fordum	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, small stones.
FnB Freeon	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Poor: small stones.
FnC2 Freeon	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope.	Moderate: wetness, slope.	Poor: small stones.
FrA Friendship	Severe: wetness, poor filter.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Gr Greenwood	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.

Table 14.--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
HaB---------- Haugen	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness.	Poor: seepage, small stones.
HaC---------- Haugen	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too sandy.	Moderate: wetness, slope.	Poor: seepage, small stones.
HgC:					
Haugen----------	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too sandy.	Moderate: wetness, slope.	Poor: seepage, small stones.
Greenwood----------	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
HvC2---------- Hayriver	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
HvD---------- Hayriver	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope.
HyB---------- Hayriver	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
HzF:					
Hayriver----------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope.
Twinmound----------	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.
MaB---------- Magnor	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
Me---------- Markey	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Mh---------- Meehan	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
MnA, MnB---------- Menahga	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Table 14.--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
MnC---------- Menahga	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MnD---------- Menahga	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Mo---------- Moppet	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: thin layer.
NeB---------- Newood	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Moderate: wetness, too sandy.	Moderate: wetness.	Poor: small stones.
NeC---------- Newood	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too sandy.	Moderate: wetness, slope.	Poor: small stones.
NoD---------- Newot	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Ns---------- Newson	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, ponding.	Severe: flooding, 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.
OsC2---------- Otterholt	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
OsD---------- Otterholt	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Pc. Pits					
PdB---------- Plainbo	Severe: depth to rock, poor filter.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.
PdC---------- Plainbo	Severe: depth to rock, poor filter.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, seepage, too sandy.
PdD---------- Plainbo	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.

Table 14.--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
Px---------- Poskin	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
QuA---------- Quarderer	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Good.
Rb---------- Rib	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, small stones.
RhC---------- Ribhill	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: depth to rock, large stones.
RhE---------- Ribhill	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: depth to rock, large stones, slope.
RoA, RoB---------- Rosholt	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
RoC2---------- Rosholt	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Ru. Rubble land					
SaB---------- Santiago	Severe: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Poor: small stones.
SaC2---------- Santiago	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: small stones.
SaD2---------- Santiago	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
ScA---------- Scoba	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Sm: Seelyeville--------	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Cathro----------	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.

Table 14.--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
SoA---------- Siouxcreek	Severe: depth to rock, wetness, poor filter.	Severe: seepage, depth to rock, wetness.	Severe: depth to rock, seepage, wetness.	Severe: depth to rock, seepage, wetness.	Poor: depth to rock, wetness.
SrB---------- Spencer	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
SrC2---------- Spencer	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope.	Moderate: wetness, slope.	Fair: slope, wetness.
Ud. Udorthents					
Va---------- Vancecreek	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
WkC2---------- Wickware	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
WkD2---------- Wickware	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

Table 15.--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
Ad Adolph	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
AfA Aftad	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
AhA Almena	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
AlD Amery	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
AmD: Amery	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Greenwood	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
AnA, AnB, AnC2 Anigon	Good	Probable	Probable	Poor: small stones, area reclaim.
ApB Arland	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
ApC2 Arland	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones, slope.
ApD Arland	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
AsB Arland	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
AsC2 Arland	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones, slope.
Au Auburndale	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
Ba Barronett	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Be Beseman	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness, too acid.
BpA Brill	Good	Probable	Probable	Poor: small stones, area reclaim.
CaC2 Campia	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Cb Capitola	Poor: wetness.	Probable	Probable	Poor: small stones, area reclaim, wetness.
CkA, CkB, CkC2 Chetek	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
ClD: Chetek	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Rosholt	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Cm Comstock	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, thin layer.
CsC: Cress	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Mahtomedi	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
CsD: Cress	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Mahtomedi	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CuA, CuB---------- Crystal Lake	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
DoB---------- Dobie	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
DoC2---------- Dobie	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones, slope.
DoD2---------- Dobie	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
DrB---------- Doritty	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Fm---------- Fordum	Poor: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim, wetness.
FnB, FnC2---------- Freeon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
FrA---------- Friendship	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
Gr---------- Greenwood	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
HaB, HaC---------- Haugen	Fair: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim.
HgC:				
Haugen----------	Fair: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim.
Greenwood----------	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
HvC2---------- Hayriver	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones, slope.
HvD---------- Hayriver	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HyB---------- Hayriver	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HzF:				
Hayriver	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Twinmound	Poor: depth to rock, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones, slope.
MaB Magnor	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Me Markey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Mh Meehan	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, too acid.
MnA, MnB, MnC Menahga	Good	Probable	Improbable: too sandy.	Poor: too sandy.
MnD Menahga	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Mo Moppet	Fair: wetness.	Probable	Probable	Poor: area reclaim.
NeB, NeC Newood	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
NoD Newot	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Ns Newson	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Oe Oesterle	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
OsC2 Otterholt	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
OsD Otterholt	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Pc. Pits				
PdB, PdC Plainbo	Poor: depth to rock.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.

Table 15.--Cons*ruction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PdD---------- Plainbo	Poor: depth to rock.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
Px---------- Poskin	Fair: wetness.	Probable----------	Probable----------	Poor: area reclaim.
QuA---------- Quarderer	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
Rb---------- Rib	Poor: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim, wetness.
RhC---------- Ribhill	Poor: depth to rock, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones.
RhE---------- Ribhill	Poor: depth to rock, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, slope.
RoA, RoB, RoC2-------- Rosholt	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
Ru. Rubble land				
SaB, SaC2---------- Santiago	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
SaD2---------- Santiago	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
ScA---------- Scoba	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
Sm: Seelyeville----------	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Cathro----------	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
SoA---------- Siouxcreek	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones, thin layer.
SrB, SrC2---------- Spencer	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

Table 15.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ud---------- Udorthents	---	Improbable: excess fines.	Improbable: excess fines.	---
Va---------- Vancecreek	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WkC2---------- Wickware	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
WkD2---------- Wickware	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

Table 16.--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--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ad Adolph	Moderate: seepage.	Severe: piping, ponding.	Ponding, frost action.	Ponding, percs slowly, rooting depth.	Ponding	Wetness, rooting depth.
AfA Aftad	Moderate: seepage.	Severe: piping.	Favorable	Wetness, soil blowing.	Erodes easily, wetness, soil blowing.	Erodes easily, rooting depth.
AhA Almena	Moderate: seepage.	Severe: thin layer.	Frost action	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
AlD Amery	Severe: slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Slope, soil blowing.	Slope, droughty, rooting depth.
AmD: Amery	Severe: slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Slope, soil blowing.	Slope, droughty, rooting depth.
Greenwood	Severe: seepage.	Severe: excess humus, ponding.	Ponding, frost action.	Ponding	Ponding	Wetness.
AnA Anigon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Rooting depth, erodes easily.	Erodes easily, too sandy.	Erodes easily, rooting depth.
AnB Anigon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, rooting depth, erodes easily.	Erodes easily, too sandy.	Erodes easily, rooting depth.
AnC2 Anigon	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, rooting depth, erodes easily.	Slope, erodes easily, too sandy.	Slope, erodes easily, rooting depth.
ApB Arland	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing, depth to rock.	Depth to rock, soil blowing.	Depth to rock.
ApC2, ApD Arland	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
AsB Arland	Severe: seepage.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock	Depth to rock.
AsC2 Arland	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
Au Auburndale	Moderate: seepage.	Severe: thin layer, ponding.	Ponding, frost action.	Ponding, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ba---------- Barronett	Moderate: seepage.	Severe: piping, ponding.	Ponding, frost action.	Ponding--------	Erodes easily, ponding.	Wetness, erodes easily.
Be---------- Beseman	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides, frost action.	Ponding, rooting depth.	Ponding--------	Wetness, rooting depth.
BpA---------- Brill	Severe: seepage.	Severe: seepage, piping.	Deep to water	Rooting depth, erodes easily.	Erodes easily, too sandy.	Erodes easily, rooting depth.
CaC2---------- Campia	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Cb---------- Capitola	Moderate: seepage.	Severe: seepage, piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing, rooting depth.	Large stones, erodes easily, ponding.	Large stones, wetness, erodes easily.
CkA---------- Chetek	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
CkB---------- Chetek	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
CkC2---------- Chetek	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
ClD:						
Chetek----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Rosholt----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty, rooting depth.
Cm---------- Comstock	Moderate: seepage.	Severe: piping.	Frost action, cutbanks cave.	Wetness, erodes easily.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
CsC, CsD:						
Cress----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
Mahtomedi--------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy.	Slope, droughty, rooting depth.
CuA---------- Crystal Lake	Moderate: seepage.	Severe: piping.	Frost action, cutbanks cave.	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
CuB---------- Crystal Lake	Moderate: seepage, slope.	Severe: piping.	Frost action, slope, cutbanks cave.	Slope, wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
DoB---------- Dobie	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock, rooting depth.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
DoC2, DoD2-------- Dobie	Severe: slope.	Severe: piping.	Deep to water	Slope, depth to rock, rooting depth.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
DrB---------- Doritty	Moderate: seepage, slope.	Severe: piping.	Frost action, slope.	Slope, wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
Fm---------- Fordum	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, flooding, frost action.	Ponding, droughty, flooding.	Erodes easily, ponding, too sandy.	Wetness, erodes easily, droughty.
FnB---------- Freeon	Moderate: slope.	Severe: seepage, piping.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, rooting depth.
FnC2---------- Freeon	Severe: slope.	Severe: seepage, piping.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
FrA---------- Friendship	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Gr---------- Greenwood	Severe: seepage.	Severe: excess humus, ponding.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
HaB---------- Haugen	Moderate: seepage, slope.	Severe: seepage, piping.	Slope, cutbanks cave.	Slope, wetness, soil blowing.	Wetness, too sandy.	Favorable.
HaC---------- Haugen	Severe: slope.	Severe: seepage, piping.	Slope, cutbanks cave.	Slope, wetness, soil blowing.	Slope, wetness, too sandy.	Slope.
HgC:						
Haugen----------	Severe: slope.	Severe: seepage, piping.	Slope, cutbanks cave.	Slope, wetness, soil blowing.	Slope, wetness, too sandy.	Slope.
Greenwood--------	Severe: seepage.	Severe: excess humus, ponding.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
HvC2, HvD--------- Hayriver	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, soil blowing.	Slope, depth to rock, rooting depth.
HyB---------- Hayriver	Severe: seepage.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock	Depth to rock, rooting depth.
HzF:						
Hayriver---------	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, soil blowing.	Slope, depth to rock, rooting depth.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
HzF:						
Twinmound	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, depth to rock, too sandy.	Slope, droughty, depth to rock.
MaB---- Magnor	Moderate: seepage.	Severe: piping.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
Me---- Markey	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
Mh---- Meehan	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave, too acid.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
MnA---- Menahga	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
MnB---- Menahga	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
MnC, MnD---- Menahga	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Mo---- Moppet	Severe: seepage.	Severe: piping.	Flooding----	Wetness, soil blowing, rooting depth.	Wetness, soil blowing.	Rooting depth.
NeB---- Newood	Moderate: seepage, slope.	Severe: seepage, piping.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Droughty, rooting depth.
NeC---- Newood	Severe: slope.	Severe: seepage, piping.	Percs slowly, slope, cutbanks cave.	Slope, wetness, droughty.	Slope, wetness, too sandy.	Slope, droughty, rooting depth.
NoD---- Newot	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty, soil blowing.	Slope, soil blowing, percs slowly.	Slope, droughty, rooting depth.
Ns---- Newson	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, flooding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty, rooting depth.
Oe---- Oesterle	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, droughty, soil blowing.	Wetness, too sandy.	Wetness, droughty.
OsC2, OsD---- Otterholt	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Pc. Pits						
PdB---------- Plainbo	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Depth to rock, too sandy.	Droughty, depth to rock.
PdC, PdD---------- Plainbo	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, depth to rock, too sandy.	Slope, droughty, depth to rock.
Px---------- Poskin	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, rooting depth, erodes easily.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, rooting depth.
QuA---------- Quarderer	Moderate: seepage.	Severe: piping.	Deep to water	Flooding--------	Erodes easily	Erodes easily.
Rb---------- Rib	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, flooding, frost action.	Ponding, rooting depth, flooding.	Erodes easily, ponding, too sandy.	Wetness, erodes easily, rooting depth.
RhC, RhE---------- Ribhill	Severe: slope.	Severe: seepage, piping, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
RoA---------- Rosholt	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty--------	Too sandy------	Droughty, rooting depth.
RoB---------- Rosholt	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Too sandy------	Droughty, rooting depth.
RoC2---------- Rosholt	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty, rooting depth.
Ru. Rubble land						
SaB---------- Santiago	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, percs slowly, rooting depth.	Erodes easily, percs slowly.	Erodes easily, rooting depth.
SaC2, SaD2-------- Santiago	Severe: slope.	Severe: piping.	Deep to water	Slope, percs slowly, rooting depth.	Slope, erodes easily, percs slowly.	Slope, erodes easily, rooting depth.
ScA---------- Scoba	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, rooting depth.	Too sandy------	Droughty, rooting depth.
Sm: Seelyeville------	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.

Table 16.--Water Management--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Sm: Cathro	Severe: seepage.	Severe: piping, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
SoA: Siouxcreek	Severe: seepage.	Severe: piping.	Depth to rock	Wetness, depth to rock, erodes easily.	Depth to rock, erodes easily, wetness.	Wetness, erodes easily, depth to rock.
SrB: Spencer	Moderate: seepage, slope.	Moderate: thin layer, piping, wetness.	Frost action, slope.	Slope, wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
SrC2: Spencer	Severe: slope.	Moderate: thin layer, piping, wetness.	Frost action, slope.	Slope, wetness, erodes easily.	Slope, erodes easily, wetness.	Slope, erodes easily.
Ud. Udorthents						
Va: Vancecreek	Moderate: seepage.	Severe: ponding.	Ponding, flooding, frost action.	Ponding, flooding.	Erodes easily, ponding.	Wetness, erodes easily.
WkC2, WkD2: Wickware	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

Table 17.--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 > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
Ad----------	0-13	Silt loam-----	ML, CL-ML	A-4, A-6, A-7	0	0	100	90-100	85-100	80-95	25-45	4-15
Adolph	13-30	Silt loam, very fine sandy loam, loam.	ML, CL-ML	A-4	0	0	100	90-100	85-100	80-95	15-25	NP-5
	30-36	Sandy loam, fine sandy loam, gravelly sandy loam.	SM, SC-SM	A-4, A-2	0-2	0-2	80-95	70-90	50-80	30-45	15-25	NP-3
	36-60	Sandy loam, fine sandy loam, gravelly sandy loam.	SM, SC-SM	A-4, A-2	0-2	0-2	80-95	70-90	50-80	30-45	15-25	NP-3
AfA----------	0-9	Fine sandy loam.	SM	A-4	0	0	95-100	90-100	65-90	35-50	<18	NP-3
Aftad	9-18	Very fine sandy loam, loam, loamy sand.	SM, SC-SM, ML, CL-ML	A-4, A-2-4	0	0	95-100	90-100	45-95	25-80	<23	NP-6
	18-32	Very fine sandy loam, sandy loam, loam.	SM, SC, ML, CL	A-4	0	0	95-100	90-100	65-95	35-80	18-26	NP-8
	32-60	Stratified sandy loam to silt loam.	SM, SC-SM, ML, CL-ML	A-4, A-2-4	0	0	95-100	90-100	65-95	25-90	<23	NP-6
AhA----------	0-14	Silt loam-----	CL	A-4, A-6	0	0-9	85-100	85-100	80-100	75-100	25-32	7-13
Almena	14-22	Silt loam-----	CL, CL-ML, ML	A-4, A-6	0	0-9	85-100	85-100	80-100	75-100	21-32	4-13
	22-27	Silt loam-----	CL, ML	A-6, A-4	0	0-9	85-100	85-100	80-100	75-100	25-35	7-15
	27-48	Silt loam-----	CL	A-4, A-6	0	0-9	85-100	85-100	80-100	70-100	28-35	9-15
	48-60	Sandy loam, gravelly loam, gravelly sandy loam.	SM, SC, ML, CL	A-2, A-4, A-1	0-2	0-9	70-100	50-95	30-90	15-70	21-30	4-11

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
AlD---------- Amery	0-3	Sandy loam----	SM, SC-SM	A-4, A-2-4, A-1-b	0	0-10	80-100	75-98	45-80	20-50	<23	NP-6
	3-22	Sandy loam, loam, gravelly fine sandy loam.	ML, CL-ML, SM, SC-SM	A-4, A-2-4, A-1-b	0-5	0-10	75-100	70-98	40-95	20-80	<23	NP-7
	22-41	Sandy loam, fine sandy loam, gravelly sandy loam.	SM, SC-SM, ML, CL-ML	A-4, A-2-4, A-1-b	0-5	0-10	55-100	50-95	30-90	15-65	15-23	NP-7
	41-71	Gravelly sandy loam, fine sandy loam, sandy loam.	SM, SC, SP-SM	A-4, A-2-4, A-1-b	0-5	0-10	55-100	50-95	25-85	10-50	<28	NP-9
	71-80	Sandy loam, fine sandy loam, gravelly loamy sand.	SM, SC-SM, SP-SM	A-4, A-2-4, A-1-b	0-5	0-10	55-100	50-95	20-80	7-45	<23	NP-7
AmD:												
Amery--------	0-3	Sandy loam----	SM, SC-SM	A-4, A-2-4, A-1-b	2-3	0-10	80-100	75-98	45-80	20-50	<23	NP-6
	3-22	Sandy loam, loam, gravelly fine sandy loam.	ML, CL-ML, SM, SC-SM	A-4, A-2-4, A-1-b	2-5	0-10	75-100	70-98	40-95	20-80	<23	NP-7
	22-41	Sandy loam, fine sandy loam, gravelly sandy loam.	SM, SC-SM, ML, CL-ML	A-4, A-2-4, A-1-b	2-5	0-10	55-100	50-95	30-90	15-65	15-23	NP-7
	41-71	Gravelly sandy loam, fine sandy loam, sandy loam.	SM, SC, SP-SM	A-4, A-2-4, A-1-b	1-5	0-10	55-100	50-95	25-85	10-50	<28	NP-9
	71-80	Sandy loam, fine sandy loam, gravelly loamy sand.	SM, SC-SM, SP-SM	A-4, A-2-4, A-1-b	0-5	0-10	55-100	50-95	20-80	7-45	<23	NP-7
Greenwood----	0-12	Peat----------	PT	A-8	0	0	---	---	---	---	---	---
	12-60	Mucky peat----	PT	A-8	0	0	---	---	---	---	---	---

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
AnA, AnB, AnC2--- Anigon	0-5	Silt loam---	CL, CL-ML	A-4	0	0-9	95-100	90-100	70-100	65-90	21-30	4-11
	5-12	Silt loam, silt.	ML, CL, CL-ML	A-4	0	0-9	95-100	90-100	70-100	65-100	<30	NP-11
	12-33	Silt loam---	CL, ML	A-4, A-6	0	0-9	95-100	90-100	70-100	65-90	28-35	9-15
	33-37	Sandy loam, loam, gravelly loamy sand.	CL, ML, SP-SM, SC	A-4, A-6, A-1, A-2	0	0-9	50-100	45-100	25-95	7-75	<32	NP-13
	37-60	Coarse sand, extremely gravelly coarse sand, gravelly sand.	GP, SP, SP-SM, GP-GM	A-1, A-2, A-3	0	0-9	30-100	25-100	10-70	1-12	---	NP
ApB, ApC2, ApD--- Arland	0-8	Fine sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4	0	0	80-100	75-100	45-90	20-55	<25	NP-6
	8-15	Sandy loam, loam, silt loam.	ML, SM, CL-ML, SC-SM	A-4, A-2	0	0	80-100	75-100	45-95	20-85	<25	NP-8
	15-23	Sandy loam, fine sandy loam, loam.	SC-SM, CL-ML	A-2, A-4	0	0	80-100	75-100	45-95	20-80	20-25	4-8
	23-36	Sandy loam, fine sandy loam, loam.	SC, SC-SM, CL, CL-ML	A-2, A-4	0	0	80-98	75-98	45-90	20-85	21-28	4-9
	36-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
AsB, AsC2--- Arland	0-8	Silt loam---	CL-ML, SC-SM	A-4	0	0	80-100	75-100	55-100	45-100	20-25	4-8
	8-15	Sandy loam, loam, silt loam.	ML, SM, CL-ML, SC-SM	A-4, A-2	0	0	80-100	75-100	45-95	20-85	<25	NP-8
	15-23	Sandy loam, fine sandy loam, loam.	SC-SM, CL-ML	A-2, A-4	0	0	80-100	75-100	45-95	20-80	20-25	4-8
	23-36	Sandy loam, fine sandy loam, loam.	SC, SC-SM, CL, CL-ML	A-2, A-4	0	0	80-98	75-98	45-90	20-85	21-28	4-9
	36-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
Au--- Auburndale	0-4	Silt loam---	CL, ML, CL-ML	A-4, A-6	0	0-5	90-100	85-100	80-100	80-100	<35	2-15
	4-18	Silt loam, silt.	ML, CL-ML, CL	A-4, A-6	0	0-5	90-100	85-100	80-100	80-100	<30	NP-11
	18-46	Silt loam---	CL	A-6	0	0-5	90-100	85-100	80-100	75-100	25-35	10-17
	46-60	Sandy loam, gravelly sandy loam, loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0	0-5	55-100	50-90	40-85	20-80	<25	NP-7

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
Ba	0-8	Silt loam	ML, CL, CL-ML	A-4	0	0-2	95-100	90-100	90-100	85-95	<26	NP-8
Barronett	8-13	Silt loam, silt.	ML, CL, CL-ML	A-4	0	0-2	95-100	90-100	85-100	85-95	<26	NP-8
	13-36	Silt loam, silty clay loam.	CL	A-6, A-4	0	0-2	95-100	90-100	90-100	85-100	28-35	9-15
	36-60	Stratified silt loam to very fine sand.	CL, CL-ML	A-4	0	0-2	95-100	90-100	80-100	70-95	21-28	4-9
Be	0-3	Peat	PT	A-8	0	0	---	---	---	---	---	---
Beseman	3-31	Sapric material.	PT	A-8	0	0	---	---	---	---	---	---
	31-60	Loam, sandy loam.	CL, ML, SM, SC	A-2, A-4, A-6	0-1	0-2	75-100	65-100	40-95	25-75	15-30	NP-12
BpA	0-7	Silt loam	CL-ML, CL	A-4	0	0-9	95-100	90-100	70-100	65-90	21-30	4-11
Brill	7-11	Silt loam, silt.	ML, CL-ML, CL	A-4	0	0-9	95-100	90-100	70-100	65-100	<30	NP-11
	11-19	Silt loam	CL-ML, CL	A-4	0	0-9	95-100	90-100	70-100	65-90	21-30	4-11
	19-34	Silt loam	CL	A-6, A-4	0	0-9	95-100	90-100	70-100	65-90	28-35	9-15
	34-38	Loam, gravelly sandy loam, sand.	ML, CL, SC, SP-SM	A-4, A-2, A-1, A-6	0	0-9	50-100	45-100	25-95	7-75	<32	NP-13
	38-60	Gravelly sand, coarse sand, very gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-2, A-3, A-1	0	0-9	30-100	25-100	10-70	1-12	---	NP
CaC2	0-9	Silt loam	CL-ML, CL, ML	A-4, A-6	0	0	95-100	90-100	90-100	85-100	18-32	3-13
Campia	9-14	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	95-100	90-100	90-100	85-100	25-32	7-13
	14-19	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	95-100	90-100	90-100	85-100	25-35	9-15
	19-34	Silty clay loam, silt loam.	CL	A-6, A-4	0	0	95-100	90-100	90-100	85-100	25-40	9-20
	34-60	Stratified silty clay loam to fine sand.	CL, CL-ML, ML	A-4, A-6	0	0	95-100	90-100	85-100	65-100	18-35	3-15

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
Cb----------	0-3	Muck----------	PT	A-8	0	0	---	---	---	---	---	NP
Capitola	3-7	Silt loam, loam.	CL, CL-ML	A-4	0	0-15	80-100	75-100	60-100	50-90	23-26	6-8
	7-27	Silt loam, loam, sandy loam.	CL, ML, SM, SC	A-4, A-2-4	0-5	0-15	80-100	75-100	45-100	20-90	<28	NP-9
	27-36	Fine sandy loam, sandy loam, gravelly sandy loam.	SM, SC	A-4, A-1-b, A-2-4	0-10	0-25	65-100	55-95	35-85	15-50	<26	NP-8
	36-60	Fine sandy loam, sandy loam, gravelly loamy sand.	SM, SP-SM	A-4, A-1-b, A-2-4	0-10	0-25	65-100	55-95	20-85	8-50	<21	NP-4
CkA, CkB, CkC2----------	0-10	Sandy loam----	SM, SC-SM	A-4, A-2-4	0	0-15	80-100	75-100	45-70	25-40	<23	NP-6
Chetek	10-16	Sandy loam, loam, gravelly sandy loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-2	0-15	55-100	50-100	45-95	25-75	<31	NP-13
	16-20	Loamy sand, gravelly loamy sand, gravelly sand.	SM, SP-SM	A-2-4, A-1, A-3	0-5	0-15	30-95	25-95	25-65	5-25	<21	NP-4
	20-60	Stratified sand to very gravelly coarse sand.	SP, SP-SM	A-1-b	0-5	0-15	30-95	25-95	15-50	1-10	---	NP
ClD: Chetek-------	0-10	Sandy loam----	SM, SC-SM	A-4, A-2-4	0	0-15	80-100	75-100	45-70	25-40	<23	NP-6
	10-16	Sandy loam, loam, gravelly sandy loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-2	0-15	55-100	50-100	45-95	25-75	<31	NP-13
	16-20	Loamy sand, gravelly loamy sand, gravelly sand.	SM, SP-SM	A-2-4, A-1, A-3	0-5	0-15	30-95	25-95	25-65	5-25	<21	NP-4
	20-60	Stratified sand to very gravelly coarse sand.	SP, SP-SM	A-1-b	0-5	0-15	30-95	25-95	15-50	1-10	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
ClD:												
Rosholt------	0-8	Loam----------	SC-SM, CL-ML, SM, ML	A-4	0	0-3	80-100	75-100	55-100	45-90	<25	NP-7
	8-11	Fine sandy loam, gravelly loamy sand, silt loam.	SM, ML, SC-SM, CL-ML	A-2, A-4, A-1	0-1	0-3	55-100	50-100	20-100	7-90	<23	NP-6
	11-32	Fine sandy loam, sandy loam, gravelly loam.	SC, SM, CL, ML	A-2, A-4, A-1	0-1	0-3	55-100	50-100	30-95	15-80	<26	NP-8
	32-36	Gravelly loamy sand, extremely gravelly coarse sand, sand.	SM, GM, SP-SM, GP-GM	A-1, A-2, A-3	0-5	0-25	30-100	25-100	15-75	8-35	<23	NP-6
	36-60	Stratified extremely gravelly sand to coarse sand.	GP, SP, SM, GM	A-1, A-2, A-3	0-5	0-25	30-100	25-100	7-70	1-25	---	NP
Cm---------- Comstock	0-9	Silt loam-----	CL-ML, CL, ML	A-4, A-6	0	0-2	95-100	95-100	90-100	85-100	20-35	3-15
	9-12	Silt loam-----	CL-ML, CL, ML	A-4	0	0-2	95-100	95-100	90-100	85-100	20-30	3-10
	12-26	Silt loam, silty clay loam.	CL	A-4, A-6	0	0-2	95-100	95-100	90-100	85-100	25-35	8-15
	26-40	Silt loam, silty clay loam.	CL	A-6, A-4	0	0-2	95-100	95-100	90-100	70-100	25-40	9-20
	40-60	Stratified silt to fine sand.	CL, ML, CL-ML	A-4	0	0-2	95-100	95-100	85-100	65-95	20-30	3-10
CsC, CsD:												
Cress--------	0-3	Sandy loam----	SM, SC, ML, CL	A-4, A-2-4	0	0-5	85-100	80-100	50-90	25-55	<28	NP-9
	3-15	Sandy loam, fine sandy loam.	SM, SC, ML, CL	A-4, A-2-4	0	0-5	75-100	70-100	40-90	20-55	<28	NP-9
	15-36	Loamy sand, coarse sand, gravelly sand.	SM, SP, SP-SM, GP	A-1-a, A-3	0	0-5	35-75	30-75	9-55	1-25	<20	NP
	36-60	Gravelly sand, sand, very gravelly coarse sand.	SM, SP, SP-SM, GP	A-1-a	0-1	0-5	35-75	30-75	9-30	1-20	<20	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
CsC, CsD:												
Mahtomedi----	0-4	Loamy sand----	SM, SC-SM	A-2, A-1	0	0-2	95-100	75-90	40-85	15-30	15-20	NP-4
	4-26	Sand, coarse sand, gravelly sand.	SP-SM, SM	A-2, A-3, A-1	0	0-10	70-95	50-90	30-75	5-15	15-20	NP
	26-60	Sand, coarse sand, gravelly sand.	SP, SM, SP-SM	A-2, A-3, A-1	0	0-10	55-95	50-90	30-70	2-15	15-20	NP
CuA, CuB------ Crystal Lake	0-8	Silt loam-----	CL-ML, CL, ML	A-4	0	0-2	98-100	97-100	85-100	80-100	18-30	3-11
	8-12	Silt loam, silt.	CL, ML, CL-ML	A-4	0	0-2	98-100	97-100	90-100	85-100	18-30	3-11
	12-20	Silt loam, silty clay loam.	CL	A-4, A-6	0	0-2	98-100	97-100	90-100	85-100	25-36	7-16
	20-34	Silt loam, silty clay loam.	CL	A-6, A-4	0	0-2	98-100	97-100	90-100	85-100	28-40	9-18
	34-60	Stratified silt loam to fine sand.	CL, CL-ML, ML	A-4	0	0-2	98-100	97-100	75-100	60-90	18-30	3-11
DoB, DoC2, DoD2--------- Dobie	0-8	Silt loam-----	CL, CL-ML	A-4	0	0	100	95-100	80-100	75-100	20-30	4-9
	8-16	Silt loam-----	CL	A-4, A-6	0	0	95-100	90-100	80-100	75-100	25-35	7-15
	16-26	Silt loam-----	CL	A-6	0	0	95-100	90-100	80-100	75-100	28-36	9-15
	26-37	Loam, very fine sandy loam, channery sandy loam.	SM, SC, ML, CL	A-4, A-2-4, A-1-b	0	0	75-100	70-100	40-95	20-75	<30	NP-9
	37-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
DrB---------- Doritty	0-9	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-30	4-13
	9-12	Silt loam-----	CL, CL-ML	A-4	0	0	100	100	100	90-100	20-30	4-11
	12-18	Silt loam-----	CL	A-4, A-6	0	0	100	100	100	90-100	25-35	7-15
	18-38	Silt loam-----	CL	A-4, A-6	0	0	100	100	100	90-100	25-35	9-16
	38-60	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	4-15
Fm---------- Fordum	0-8	Silt loam-----	ML, CL, SM, SC	A-4, A-6	0	0-15	80-100	75-100	55-100	45-85	20-35	3-15
	8-27	Silt loam, sandy loam, gravelly loam.	SM, SC, ML, CL	A-2, A-4, A-1	0	0-15	30-100	25-100	20-100	10-90	<30	3-10
	27-60	Sand, very gravelly loamy fine sand.	SP, SM, GP, SM	A-3, A-2, A-1	0	0-15	30-100	25-100	7-95	1-50	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
FnB, FnC2----- Freeon	0-7	Silt loam-----	ML, CL, CL-ML	A-4	0	0-5	90-100	85-100	70-100	60-95	<30	NP-10
	7-19	Silt loam, silt.	ML, CL, CL-ML	A-4	0-5	0-5	90-100	85-100	70-100	60-95	<30	NP-10
	19-39	Sandy loam, loamy sand, gravelly loam.	ML, CL, SP-SM, SC	A-4, A-1, A-2, A-3	0-5	0-5	55-100	50-95	20-85	7-70	<30	NP-10
	39-85	Sandy loam, gravelly loam, fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-5	0-15	55-100	50-95	30-85	15-70	<25	NP-10
	85-99	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2, A-1	0-5	0-15	55-100	50-95	30-85	15-70	<25	NP-10
FrA----------- Friendship	0-9	Loamy sand----	SM, SP-SM	A-1, A-2	0	0	75-100	75-100	40-75	12-30	---	NP
	9-16	Sand, loamy sand, coarse sand.	SP-SM, SM, SP	A-1, A-2, A-3	0	0	75-100	75-100	40-75	3-30	---	NP
	16-27	Sand, coarse sand.	SP-SM, SM, SP	A-1, A-3, A-2	0	0	75-100	75-100	40-70	3-15	---	NP
	27-60	Sand, coarse sand.	SP-SM, SM, SP	A-1, A-3, A-2	0	0	75-100	75-100	40-70	3-15	---	NP
Gr---------- Greenwood	0-12	Peat----------	PT	A-8	0	0	---	---	---	---	---	---
	12-60	Mucky peat----	PT	A-8	0	0	---	---	---	---	---	---
HaB, HaC------ Haugen	0-4	Sandy loam----	SM, SC-SM	A-2-4, A-4, A-1	0	0-15	80-100	75-100	45-80	20-50	<25	NP-7
	4-23	Sandy loam, fine sandy loam, gravelly loam.	ML, CL-ML, SM, SC-SM	A-4, A-2, A-1	0-1	0-15	55-100	50-95	30-95	15-75	<25	NP-7
	23-35	Sandy loam, gravelly fine sandy loam, loam.	ML, CL-ML, SM, SC-SM	A-4, A-2, A-1	0-2	0-15	55-100	50-95	30-95	15-75	<25	NP-7
	35-79	Sandy loam, gravelly sandy loam, gravelly loamy sand.	SM, SC, SP-SM, GP-GM	A-4, A-2, A-1, A-3	0-2	0-15	55-100	50-95	20-75	7-40	<28	NP-9
	79-88	Sandy loam, gravelly loamy sand, fine sandy loam.	SM, SC, SC-SM	A-4, A-2, A-1	0-2	0-15	55-100	50-95	20-70	7-40	<28	NP-9

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
HgC:												
Haugen-------	0-4	Sandy loam----	SM, SC-SM	A-2-4, A-4, A-1	2-3	0-15	80-100	75-100	45-80	20-50	<25	NP-7
	4-23	Sandy loam, fine sandy loam, gravelly loam.	ML, CL-ML, SM, SC-SM	A-4, A-2, A-1	2-5	0-15	55-100	50-95	30-95	15-75	<25	NP-7
	23-35	Sandy loam, gravelly fine sandy loam, loam.	ML, CL-ML, SM, SC-SM	A-4, A-2, A-1	2-5	0-15	55-100	50-95	30-95	15-75	<25	NP-7
	35-79	Sandy loam, gravelly sandy loam, gravelly loamy sand.	SM, SC, SP-SM, GP-GM	A-4, A-2, A-1, A-3	1-5	0-15	55-100	50-95	20-75	7-40	<28	NP-9
	79-88	Sandy loam, gravelly loamy sand, fine sandy loam.	SM, SC, SC-SM	A-4, A-2, A-1	0-5	0-15	55-100	50-95	20-70	7-40	<28	NP-9
Greenwood----	0-12	Peat----------	PT	A-8	0	0	---	---	---	---	---	---
	12-60	Mucky peat----	PT	A-8	0	0	---	---	---	---	---	---
HvC2, HvD----- Hayriver	0-8	Fine sandy loam.	SM, SC-SM, CL-ML, ML	A-2, A-4	0	0-2	85-100	80-100	70-85	30-55	<25	NP-7
	8-13	Fine sandy loam, sandy loam, loam.	SM, SC-SM, CL-ML, ML	A-2, A-4	0	0-2	85-100	80-100	50-90	25-60	<25	NP-6
	13-30	Fine sandy loam, sandy loam, loam.	SM, SC, CL, ML	A-2, A-4	0	0-2	80-100	75-100	50-90	25-70	<25	NP-9
	30-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
HyB---------- Hayriver	0-8	Loam----------	ML, CL-ML	A-4	0	0-2	85-100	80-100	70-95	50-75	<25	NP-7
	8-13	Fine sandy loam, sandy loam, loam.	SM, SC-SM, CL-ML, ML	A-2, A-4	0	0-2	85-100	80-100	50-90	25-60	<25	NP-6
	13-30	Fine sandy loam, sandy loam, loam.	SM, SC, CL, ML	A-2, A-4	0	0-2	80-100	75-100	50-90	25-70	<25	NP-9
	30-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
HzF:												
Hayriver-----	0-8	Fine sandy loam.	SM, SC-SM, CL-ML, ML	A-2, A-4	0	0-2	85-100	80-100	70-85	30-55	<25	NP-7
	8-13	Fine sandy loam, sandy loam, loam.	SM, SC-SM, CL-ML, ML	A-2, A-4	0	0-2	85-100	80-100	50-90	25-60	<25	NP-6
	13-30	Fine sandy loam, sandy loam, loam.	SM, SC, CL, ML	A-2, A-4	0	0-2	80-100	75-100	50-90	25-70	<25	NP-9
	30-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
HzF:												
Twinmound----	0-4	Sand----------	SM, SP-SM	A-2, A-3, A-1	0	0	80-100	75-100	20-70	5-25	---	NP
	4-28	Fine sand, channery sand.	SM, SP	A-2, A-3, A-1	0	0-5	55-100	50-100	15-85	2-35	---	NP
	28-42	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
	42-46	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
MaB---------- Magnor	0-8	Silt loam-----	CL, CL-ML, ML	A-4	0	0-9	90-100	85-100	70-100	60-100	<28	NP-9
	8-18	Silt loam, silt.	CL, CL-ML, ML	A-4	0-3	0-9	90-100	85-100	70-100	60-95	<28	NP-9
	18-24	Silt loam, silt.	CL, CL-ML, ML	A-4	0-5	0-9	90-100	85-100	70-100	60-85	<28	NP-9
	24-50	Gravelly sandy loam, fine sandy loam, loam.	ML, CL, SM, SC	A-4, A-2-4, A-1-b	0-5	0-15	55-100	50-95	40-90	20-70	15-28	NP-9
	50-60	Sandy loam, loam, gravelly fine sandy loam.	ML, CL-ML, SM, SC-SM	A-4, A-2-4, A-1-b	0-5	0-15	55-100	50-90	40-85	20-70	<25	NP-7
Me---------- Markey	0-44	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
	44-60	Sand, fine sand, gravelly loamy sand.	SP, SM, SP-SM	A-2, A-3, A-1	0	0	95-100	60-100	30-75	0-30	---	NP
Mh---------- Meehan	0-5	Loamy sand----	SM	A-2, A-1	0	0	90-100	75-100	40-90	15-30	---	NP
	5-28	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-1, A-2, A-3	0	0	90-100	75-100	40-90	3-30	---	NP
	28-60	Sand, coarse sand.	SP, SP-SM	A-1, A-3, A-2	0	0	90-100	75-100	40-90	0-5	---	NP
MnA, MnB, MnC, MnD---------- Menahga	0-12	Loamy sand----	SM, SP-SM	A-2	0	0	100	85-100	60-80	10-30	---	NP
	12-32	Coarse sand, sand, loamy coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP
	32-60	Coarse sand, sand.	SP, SP-SM	A-3, A-2, A-1	0	0	100	80-100	30-75	0-10	---	NP
Mo---------- Moppet	0-4	Fine sandy loam.	SC, SC-SM, CL, CL-ML	A-4, A-2-4	0	0	100	100	60-95	30-65	21-26	4-8
	4-10	Fine sandy loam, loam, silt loam.	ML, SM, SC, CL	A-4	0	0	100	100	75-100	40-85	18-28	3-9
	10-39	Fine sandy loam, loam, silt loam.	ML, SM, SC, CL	A-4	0	0	100	100	75-100	40-85	18-28	3-9
	39-60	Gravelly sand, fine sand, loamy fine sand.	SM, SP-SM, SP	A-1-b, A-2-4, A-4	0	0-5	55-100	50-100	15-95	2-50	15-21	NP-4

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
NeB, NeC------ Newood	0-3	Sandy loam----	SM, SC-SM, ML, CL-ML	A-2, A-4	0	0-15	80-100	75-100	40-85	20-55	<25	NP-7
	3-11	Gravelly sandy loam, gravelly loam, sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1-b	0-1	0-15	70-100	65-100	40-90	20-75	<25	NP-7
	11-40	Gravelly sandy loam, sandy loam, gravelly loamy sand.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	35-80	12-45	<25	NP-7
	40-64	Gravelly sandy loam, sandy loam, fine sandy loam.	SM, SC, SC-SM, GM	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<30	NP-10
	64-80	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC-SM, GM, GM-GC	A-2, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<25	NP-7
NoD------------ Newot	0-4	Sandy loam----	SM, SC-SM	A-2-4, A-4, A-1-b	0	0-15	75-100	70-95	40-75	20-45	<25	NP-7
	4-21	Gravelly sandy loam, gravelly loam, sandy loam.	SM, SC-SM, ML, CL-ML	A-2-4, A-4, A-1-b	0-1	0-15	75-100	70-95	40-90	20-75	<25	NP-7
	21-41	Gravelly sandy loam, loam, gravelly loamy sand.	SM, SC-SM	A-2-4, A-4, A-1-b	0-1	0-15	60-100	55-95	35-80	12-45	<25	NP-7
	41-62	Gravelly sandy loam, sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2-4, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<30	NP-9
	62-80	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, SC-SM, GM	A-2-4, A-4, A-1-b	0-1	0-15	60-100	55-95	45-80	20-45	<30	NP-9
Ns------------ Newson	0-8	Loamy sand----	SM, SP-SM	A-2, A-1	0	0	80-100	75-100	40-85	12-35	<23	NP-6
	8-28	Loamy sand, sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0	80-100	75-100	45-75	3-30	---	NP
	28-60	Sand, loamy sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0	80-100	75-100	45-75	3-30	---	NP
Oe------------ Oesterle	0-8	Sandy loam----	SM, SC, SC-SM	A-2, A-4, A-1	0	0-9	80-100	75-100	45-90	20-50	18-26	3-8
	8-11	Sandy loam, loam.	ML, CL, SM, SC	A-2, A-4, A-1	0	0-9	75-100	70-100	40-95	20-75	18-26	3-8
	11-25	Sandy loam, gravelly loam.	SM, SC, CL, ML	A-2, A-1, A-4	0	0-9	55-100	50-100	25-95	15-60	<28	NP-9
	25-60	Gravelly sand, loamy sand.	SM, SP, GM, GP	A-1, A-3, A-2	0	0-9	30-100	25-100	7-75	1-35	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
OsC2, OsD-----	0-9	Silt loam-----	CL, CL-ML	A-4	0	0-9	90-100	85-100	80-100	75-100	21-28	4-9
Otterholt	9-26	Silt loam, silt.	CL	A-4, A-6	0	0-9	90-100	85-100	80-100	75-100	28-35	9-15
	26-41	Silt loam-----	CL	A-4, A-6	0	0-9	90-100	85-100	80-100	75-100	28-35	9-15
	41-45	Loam, gravelly sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-2-4, A-1	0-2	0-9	55-90	50-90	30-85	15-70	21-30	4-11
	45-60	Sandy loam, gravelly loam, loamy sand.	CL, CL-ML, SC, SP-SC	A-4, A-2-4, A-1	0-2	0-9	55-90	50-90	25-80	10-70	21-30	4-11
Pc. Pits												
PdB, PdC, PdD- Plainbo	0-9	Loamy sand----	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	0	80-100	75-100	30-80	10-35	<25	NP-7
	9-35	Sand, loamy sand.	SP-SM, SM	A-3, A-1-b, A-2-4	0	0	80-100	75-100	20-80	5-35	<21	NP-4
	35-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
Px----------	0-9	Silt loam-----	CL, CL-ML	A-4	0	0-4	95-100	90-100	80-100	70-95	20-30	5-10
Poskin	9-12	Silt loam-----	CL-ML	A-4	0	0-4	95-100	90-100	80-100	70-95	20-25	4-7
	12-19	Silt loam-----	CL	A-4, A-6	0	0-4	95-100	90-100	80-100	70-95	25-35	7-15
	19-36	Silt loam-----	CL	A-6, A-4	0	0-4	95-100	90-100	80-100	70-95	25-35	9-15
	36-39	Sandy loam, loam, gravelly sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1	0	0-10	50-100	45-100	30-100	10-90	<25	NP-7
	39-60	Gravelly sand, coarse sand, sand and gravel.	SP, SP-SM, GP, GP-GM	A-1, A-2, A-3	0	0-10	30-100	25-100	10-90	1-15	---	NP
QuA----------	0-13	Silt loam-----	CL-ML, CL	A-4	0	0	100	100	90-100	70-95	20-27	4-9
Quarderer	13-22	Silt loam-----	CL-ML, CL	A-4	0	0	100	100	90-100	80-95	20-27	4-9
	22-29	Silt loam-----	CL-ML, CL	A-4	0	0	100	100	90-100	80-95	20-27	4-9
	29-55	Silt loam-----	CL-ML, CL	A-4	0	0	90-100	85-100	75-100	60-95	20-30	4-11
	55-72	Silt loam-----	CL-ML, CL	A-4	0	0	90-100	85-100	75-100	60-95	20-26	4-8
Rb----------	0-8	Silt loam-----	CL, CL-ML	A-4, A-6	0	0-9	95-100	90-100	90-100	85-100	20-30	4-11
Rib	8-32	Silt loam, silty clay loam.	CL	A-6	0	0-9	95-100	90-100	90-100	85-100	30-40	10-20
	32-36	Loam, sandy loam, very gravelly sandy loam.	CL, ML, SC, SM	A-2, A-4, A-6, A-1	0	0-9	55-100	45-100	35-90	20-75	17-40	1-20
	36-60	Stratified very gravelly coarse sand to loamy sand.	SP, SP-SM, GP, GP-GM	A-2, A-3, A-1	0-1	0-9	45-95	40-95	25-55	2-10	---	NP

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
RhC, RhE------- Ribhill	0-3	Cobbly silt loam.	CL, CL-ML, ML	A-4	2-3	25-40	80-100	75-100	70-95	50-95	<28	NP-9
	3-17	Cobbly silt loam, silt loam.	CL, ML, SC, SM	A-4	0-5	15-40	80-100	75-100	65-95	45-85	<28	NP-9
	17-38	Cobbly silt loam, very cobbly silt loam, very cobbly sandy loam.	SC, ML, GM, CL	A-4, A-2, A-1-b	0-10	30-60	65-95	60-98	35-85	15-70	<28	NP-9
	38-42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
RoA, RoB, RoC2--------- Rosholt	0-8	Loam----------	SC-SM, CL-ML, SM, ML	A-4	0	0-3	80-100	75-100	55-100	45-90	<25	NP-7
	8-11	Fine sandy loam, gravelly loamy sand, silt loam.	SM, ML, SC-SM, CL-ML	A-2, A-4, A-1	0-1	0-3	55-100	50-100	20-100	7-90	<23	NP-6
	11-32	Fine sandy loam, sandy loam, gravelly loam.	SC, SM, CL, ML	A-2, A-4, A-1	0-1	0-3	55-100	50-100	30-95	15-80	<26	NP-8
	32-36	Gravelly loamy sand, extremely gravelly coarse sand, sand.	SM, GM, SP-SM, GP-GM	A-1, A-2, A-3	0-5	0-25	30-100	25-100	15-75	8-35	<23	NP-6
	36-60	Stratified extremely gravelly sand to coarse sand.	GP, SP, SM, GM	A-1, A-2, A-3	0-5	0-25	30-100	25-100	7-70	1-25	---	NP
Ru. Rubble land												
SaB, SaC2, SaD2--------- Santiago	0-10	Silt loam-----	ML, CL-ML	A-4	0	0-5	95-100	85-100	85-100	85-100	<25	NP-8
	10-15	Silt loam, silt.	ML, CL-ML	A-4	0-1	0-5	95-100	85-100	85-100	85-100	<25	NP-7
	15-23	Silt loam-----	CL, ML, CL-ML	A-4	0-3	0-5	95-100	85-100	85-100	85-95	<25	NP-9
	23-87	Sandy loam, gravelly fine sandy loam, loam.	CL, SC, ML, SM	A-4, A-2-4	0-5	0-15	70-100	50-95	40-90	25-70	<25	NP-9
	87-99	Sandy loam, gravelly fine sandy loam, loam.	SM, SC, ML, CL	A-4, A-2-4	0-5	0-15	70-100	50-95	35-90	20-70	<25	NP-8

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
ScA---------- Scoba	0-9	Sandy loam----	SC, SM	A-4, A-2-4	0	0-9	80-100	75-100	45-80	20-50	<26	NP-8
	9-16	Loam, sandy loam, gravelly fine sandy loam.	SC, SM, GM, CL-ML	A-4, A-2-4, A-1-b	0	0-9	55-100	50-100	30-95	15-80	<26	NP-8
	16-26	Sandy loam, gravelly loam, silt loam.	SM, SC, GM, CL-ML	A-4, A-2-4, A-1-b	0	0-9	55-100	50-100	30-100	15-90	18-28	3-9
	26-31	Loamy sand, very gravelly loamy coarse sand.	SP, SM, GP, GM	A-2-4, A-1-a, A-3	0-1	0-25	30-100	25-100	9-75	4-35	<23	NP-6
	31-60	Stratified loamy sand to very gravelly coarse sand.	SP, SM, GP, GM	A-1-a, A-3	0-1	0-25	30-100	25-100	7-75	1-35	---	NP
Sm:												
Seelyeville--	0-8	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
	8-60	Muck, mucky peat.	PT	A-8	0	0	---	---	---	---	---	---
Cathro-------	0-16	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
	16-30	Muck----------	PT	A-8	0	0	---	---	---	---	---	---
	30-60	Loam, silty clay loam, sandy loam.	SC-SM, CL-ML, SC, CL	A-4, A-6	0	0-5	80-100	65-100	60-100	35-90	20-40	4-20
SoA---------- Siouxcreek	0-8	Silt loam-----	CL, ML, CL-ML	A-4	0	0	90-100	85-100	60-95	50-80	<26	NP-8
	8-14	Loam, sandy loam, fine sandy loam.	CL, ML, SM, SC	A-4	0	0	90-100	85-100	55-95	45-80	<26	NP-8
	14-32	Loam, sandy loam, fine sandy loam.	CL, CL-ML, SC-SM, SC	A-4	0	0	90-100	85-100	55-95	45-80	21-28	4-9
	32-38	Sand, loamy fine sand, loamy sand.	SP, SM	A-4, A-1, A-3	0	0	90-100	85-100	25-95	4-50	---	NP
	38-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
SrB, SrC2----- Spencer	0-9	Silt loam-----	CL, CL-ML	A-4	0	0-9	95-100	90-100	85-100	80-100	21-28	4-9
	9-12	Silt loam, silt.	CL, CL-ML	A-4	0	0-9	95-100	90-100	85-100	80-100	21-28	4-9
	12-30	Silt loam-----	CL	A-4, A-6	0	0-9	95-100	90-100	85-100	80-100	28-35	9-15
	30-42	Silt loam-----	CL	A-4, A-6	0	0-9	95-100	90-100	85-100	80-100	28-35	9-15
	42-48	Loam, gravelly sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-2-4, A-1-b	0-2	0-9	55-90	50-90	30-85	15-70	21-30	4-11
	48-72	Sandy loam, gravelly loam, loamy sand.	CL, CL-ML, SC, SP-SC	A-4, A-2-4, A-1-b	0-2	0-9	55-90	50-90	25-80	10-70	21-30	4-11
Ud---------- Udorthents	0-60	Variable------	---	---	---	---	---	---	---	---	---	---

Table 17.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
Va----------	0-16	Silt loam-----	CL	A-4, A-6	0	0	100	100	90-100	85-95	25-35	7-14
Vancecreek	16-49	Silt loam-----	CL	A-4, A-6	0	0	100	100	90-100	85-100	28-36	9-16
	49-60	Stratified silt loam to very fine sand.	CL, CL-ML, ML	A-4, A-6	0	0	100	100	60-100	50-100	18-36	3-16
WkC2, WkD2----	0-10	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-30	4-13
Wickware	10-17	Silt loam-----	CL	A-4, A-6	0	0	100	100	100	90-100	25-35	7-15
	17-36	Silt loam-----	CL	A-4, A-6	0	0	100	100	100	90-100	25-35	9-16
	36-60	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	100	90-100	20-35	4-15

Table 18.--Physical and Chemical Properties of the Soils

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" 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
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Ad	0-13	20-27	1.20-1.30	0.6-2.0	0.18-0.24	5.6-7.3	Low	0.32	4	6	4-8
Adolph	13-30	12-18	1.40-1.60	0.6-2.0	0.17-0.22	5.6-7.3	Low	0.28			
	30-36	12-18	1.65-1.75	0.6-2.0	0.07-0.13	5.6-7.8	Low	0.28			
	36-60	10-18	1.80-2.00	<0.06	0.0-0.04	5.6-7.8	Low	0.28			
AfA	0-9	3-8	1.35-1.65	0.6-2.0	0.14-0.18	5.1-7.3	Low	0.28	5	3	1-2
Aftad	9-18	3-12	1.45-1.70	0.6-2.0	0.09-0.19	4.5-6.5	Low	0.43			
	18-32	8-15	1.50-1.70	0.6-2.0	0.10-0.19	4.5-6.5	Low	0.43			
	32-60	1-12	1.50-1.75	0.6-2.0	0.05-0.20	5.1-6.5	Low	0.32			
AhA	0-14	14-23	1.20-1.55	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.37	5	5	2-5
Almena	14-22	10-23	1.30-1.60	0.6-2.0	0.20-0.24	4.5-6.0	Low	0.43			
	22-27	15-25	1.50-1.65	0.2-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	27-48	18-27	1.50-1.65	0.2-2.0	0.20-0.22	4.5-6.0	Low	0.43			
	48-60	10-20	1.70-1.80	0.2-2.0	0.07-0.16	4.5-6.5	Low	0.28			
AlD	0-3	4-12	1.05-1.25	0.6-2.0	0.10-0.18	4.5-7.3	Low	0.24	5	3	1-3
Amery	3-22	4-15	1.50-1.70	0.6-2.0	0.10-0.22	4.5-6.0	Low	0.24			
	22-41	4-15	1.65-1.90	0.2-0.6	0.04-0.18	5.1-6.5	Low	0.24			
	41-71	6-17	1.80-2.00	0.2-0.6	0.04-0.15	5.1-6.5	Low	0.20			
	71-80	4-15	1.80-2.00	<0.2	0.0-0.04	5.6-6.5	Low	0.28			
AmD:											
Amery	0-3	4-12	1.05-1.25	0.6-2.0	0.10-0.18	4.5-7.3	Low	0.24	5	3	1-3
	3-22	4-15	1.50-1.70	0.6-2.0	0.10-0.22	4.5-6.0	Low	0.24			
	22-41	4-15	1.65-1.90	0.2-0.6	0.04-0.18	5.1-6.5	Low	0.24			
	41-71	6-17	1.80-2.00	0.2-0.6	0.04-0.15	5.1-6.5	Low	0.20			
	71-80	4-15	1.80-2.00	<0.2	0.0-0.04	5.6-6.5	Low	0.28			
Greenwood	0-12	---	0.30-0.40	>6.0	0.55-0.65	3.6-4.4		----	3	7	55-75
	12-60	---	0.10-0.25	0.6-6.0	0.45-0.55	3.6-4.4		----			
AnA, AnB	0-5	10-20	1.25-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	4	5	1-3
Anigon	5-12	8-20	1.35-1.55	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	12-33	18-27	1.50-1.60	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	33-37	6-20	1.55-1.75	0.6-6.0	0.05-0.19	4.5-6.5	Low	0.24			
	37-60	1-6	1.55-1.80	>6.0	0.01-0.07	4.5-6.5	Low	0.10			
AnC2	0-5	10-20	1.25-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.43	4	5	1-3
Anigon	5-12	8-20	1.35-1.55	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	12-33	18-27	1.50-1.60	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	33-37	6-20	1.55-1.75	0.6-6.0	0.05-0.19	4.5-6.5	Low	0.24			
	37-60	1-6	1.55-1.80	>6.0	0.01-0.07	4.5-6.5	Low	0.10			
ApB	0-8	6-12	1.20-1.70	0.6-2.0	0.10-0.18	4.5-7.3	Low	0.28	3	3	1-3
Arland	8-15	6-15	1.45-1.70	0.6-2.0	0.13-0.22	4.5-7.3	Low	0.24			
	15-23	10-15	1.40-1.70	0.6-6.0	0.09-0.19	4.5-6.5	Low	0.24			
	23-36	10-18	1.40-1.70	0.6-6.0	0.09-0.18	4.5-6.5	Low	0.24			
	36-60	---	---	0.2-2.0	---	---		----			
ApC2	0-8	6-12	1.20-1.70	0.6-2.0	0.10-0.18	4.5-7.3	Low	0.32	3	3	1-3
Arland	8-15	6-15	1.45-1.70	0.6-2.0	0.13-0.22	4.5-7.3	Low	0.24			
	15-23	10-15	1.40-1.70	0.6-6.0	0.09-0.19	4.5-6.5	Low	0.24			
	23-36	10-18	1.40-1.70	0.6-6.0	0.09-0.18	4.5-6.5	Low	0.24			
	36-60	---	---	0.2-2.0	---	---		----			

Table 18.--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
ApD	0-8	6-12	1.20-1.70	0.6-2.0	0.10-0.18	4.5-7.3	Low	0.28	3	3	1-3
Arland	8-15	6-15	1.45-1.70	0.6-2.0	0.13-0.22	4.5-7.3	Low	0.24			
	15-23	10-15	1.40-1.70	0.6-6.0	0.09-0.19	4.5-6.5	Low	0.24			
	23-36	10-18	1.40-1.70	0.6-6.0	0.09-0.18	4.5-6.5	Low	0.24			
	36-60	---	---	0.2-2.0	---	---					
AsB	0-8	10-15	1.20-1.55	0.6-2.0	0.14-0.24	4.5-7.3	Low	0.37	3	5	1-3
Arland	8-15	6-15	1.45-1.70	0.6-2.0	0.13-0.22	4.5-7.3	Low	0.24			
	15-23	10-15	1.40-1.70	0.6-6.0	0.09-0.19	4.5-6.5	Low	0.24			
	23-36	10-18	1.40-1.70	0.6-6.0	0.09-0.18	4.5-6.5	Low	0.24			
	36-60	---	---	0.2-2.0	---	---					
AsC2	0-8	10-15	1.20-1.55	0.6-2.0	0.14-0.24	4.5-7.3	Low	0.43	3	5	1-3
Arland	8-15	6-15	1.45-1.70	0.6-2.0	0.13-0.22	4.5-7.3	Low	0.24			
	15-23	10-15	1.40-1.70	0.6-6.0	0.09-0.19	4.5-6.5	Low	0.24			
	23-36	10-18	1.40-1.70	0.6-6.0	0.09-0.18	4.5-6.5	Low	0.24			
	36-60	---	---	0.2-2.0	---	---					
Au	0-4	6-25	1.35-1.55	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.37	5	5	4-10
Auburndale	4-18	6-20	1.35-1.60	0.6-2.0	0.20-0.24	4.5-6.0	Low	0.43			
	18-46	18-27	1.50-1.65	0.2-2.0	0.20-0.22	4.5-6.0	Moderate	0.43			
	46-60	5-15	1.75-1.85	0.2-2.0	0.08-0.19	4.5-6.5	Low	0.28			
Ba	0-8	5-15	1.25-1.50	0.6-2.0	0.20-0.26	4.5-7.3	Low	0.37	5	5	3-8
Barronett	8-13	4-15	1.45-1.65	0.6-2.0	0.18-0.22	4.5-6.5	Low	0.43			
	13-36	18-25	1.40-1.65	0.6-2.0	0.18-0.22	4.5-6.5	Moderate	0.43			
	36-60	10-18	1.40-1.70	0.2-0.6	0.16-0.22	4.5-7.8	Low	0.32			
Be	0-3	---	0.10-0.20	0.6-6.0	0.55-0.65	3.5-4.4	---	---	2	7	25-99
Beseman	3-31	---	0.10-0.25	0.6-6.0	0.55-0.65	3.5-4.4	---	---			
	31-60	10-27	1.55-1.95	0.2-0.6	0.11-0.18	3.5-7.3	Moderate	0.28			
BpA	0-7	10-20	1.25-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	4	5	2-4
Brill	7-11	8-20	1.35-1.55	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	11-19	10-20	1.40-1.55	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	19-34	18-27	1.50-1.60	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	34-38	6-20	1.55-1.75	0.6-6.0	0.05-0.19	4.5-6.5	Low	0.32			
	38-60	1-6	1.55-1.80	>6.0	0.01-0.07	4.5-6.5	Low	0.10			
CaC2	0-9	8-22	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.43	5	5	1-4
Campia	9-14	15-22	1.45-1.65	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	14-19	18-27	1.45-1.65	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	19-34	18-30	1.45-1.65	0.6-2.0	0.16-0.22	4.5-6.5	Low	0.43			
	34-60	8-27	1.45-1.70	0.2-0.6	0.14-0.20	5.1-7.3	Low	0.43			
Cb	0-3	---	0.15-0.35	2.0-6.0	0.35-0.45	4.5-7.3	Low	0.37	5	2	50-80
Capitola	3-7	12-16	1.25-1.45	0.6-2.0	0.16-0.24	4.5-7.3	Low	0.37			
	7-27	8-17	1.35-1.60	0.6-2.0	0.09-0.22	4.5-7.3	Low	0.43			
	27-36	8-16	1.40-1.90	0.6-2.0	0.07-0.16	4.5-7.3	Low	0.28			
	36-60	5-10	1.70-1.90	0.2-0.6	0.05-0.16	5.1-7.8	Low	0.28			
CkA, CkB	0-10	4-12	1.35-1.70	0.6-6.0	0.10-0.15	5.1-7.3	Low	0.24	3	3	1-3
Chetek	10-16	7-17	1.40-1.70	0.6-6.0	0.09-0.19	5.1-7.3	Low	0.24			
	16-20	3-10	1.60-1.70	6.0-20	0.04-0.13	5.1-7.3	Low	0.17			
	20-60	1-3	1.50-1.60	>6.0	0.02-0.04	5.1-7.3	Low	0.10			
CkC2	0-10	4-12	1.35-1.70	0.6-6.0	0.10-0.15	5.1-7.3	Low	0.28	3	3	1-3
Chetek	10-16	7-17	1.40-1.70	0.6-6.0	0.09-0.19	5.1-7.3	Low	0.24			
	16-20	3-10	1.60-1.70	6.0-20	0.04-0.13	5.1-7.3	Low	0.17			
	20-60	1-3	1.50-1.60	>6.0	0.02-0.04	5.1-7.3	Low	0.10			

Table 18.--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
ClD:											
Chetek----------	0-10	4-12	1.35-1.70	0.6-6.0	0.10-0.15	5.1-7.3	Low----------	0.24	3	3	1-3
	10-16	7-17	1.40-1.70	0.6-6.0	0.09-0.19	5.1-7.3	Low----------	0.24			
	16-20	3-10	1.60-1.70	6.0-20	0.04-0.13	5.1-7.3	Low----------	0.17			
	20-60	1-3	1.50-1.60	>6.0	0.02-0.04	5.1-7.3	Low----------	0.10			
Rosholt---------	0-8	7-13	1.50-1.60	0.6-2.0	0.16-0.24	4.5-7.3	Low----------	0.32	4	5	1-3
	8-11	3-12	1.70-1.80	0.6-6.0	0.10-0.22	4.5-6.5	Low----------	0.24			
	11-32	6-15	1.65-1.75	0.6-6.0	0.09-0.19	4.5-6.5	Low----------	0.24			
	32-36	4-12	1.55-1.65	0.6-6.0	0.04-0.16	4.5-6.5	Low----------	0.10			
	36-60	0-5	1.50-1.80	>6.0	0.02-0.04	5.1-6.5	Low----------	0.10			
Cm----------	0-9	8-22	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	5	5	2-4
Comstock	9-12	8-20	1.40-1.65	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.43			
	12-26	15-28	1.40-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate-----	0.43			
	26-40	18-30	1.40-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate-----	0.43			
	40-60	8-20	1.40-1.65	0.2-0.6	0.12-0.22	5.1-7.3	Low----------	0.37			
CsC, CsD:											
Cress----------	0-3	5-18	1.25-1.60	0.6-6.0	0.12-0.18	4.5-7.3	Low----------	0.24	3	3	.5-2
	3-15	5-18	1.40-1.70	0.6-6.0	0.10-0.17	4.5-6.5	Low----------	0.24			
	15-36	0-8	1.50-1.80	>6.0	0.02-0.07	4.5-6.0	Low----------	0.17			
	36-60	0-8	1.50-1.80	>6.0	0.01-0.03	5.1-6.5	Low----------	0.10			
Mahtomedi-------	0-4	2-15	1.40-1.60	>6.0	0.10-0.12	5.1-6.5	Low----------	0.10	5	2	.5-1
	4-26	0-10	1.45-1.75	>6.0	0.05-0.07	5.1-6.5	Low----------	0.05			
	26-60	0-10	1.45-1.75	>6.0	0.04-0.09	5.1-7.8	Low----------	0.05			
CuA, CuB---------	0-8	8-20	1.35-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	5	5	2-4
Crystal Lake	8-12	8-20	1.40-1.60	0.6-2.0	0.20-0.22	4.5-7.3	Low----------	0.43			
	12-20	15-27	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.0	Low----------	0.43			
	20-34	18-30	1.50-1.60	0.6-2.0	0.18-0.22	4.5-6.0	Moderate-----	0.43			
	34-60	8-20	1.45-1.65	0.2-0.6	0.20-0.22	4.5-7.3	Low----------	0.37			
DoB----------	0-8	10-17	1.35-1.55	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	3	5	1-3
Dobie	8-16	15-25	1.50-1.60	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.43			
	16-26	18-27	1.55-1.65	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.43			
	26-37	6-17	1.35-1.75	0.6-2.0	0.15-0.19	5.1-6.5	Low----------	0.24			
	37-60	---	---	0.06-2.0	---	---	----------	----			
DoC2, DoD2-------	0-8	10-17	1.35-1.55	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.43	3	5	1-3
Dobie	8-16	15-25	1.50-1.60	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.43			
	16-26	18-27	1.55-1.65	0.6-2.0	0.20-0.22	5.1-6.5	Low----------	0.43			
	26-37	6-17	1.35-1.75	0.6-2.0	0.15-0.19	5.1-6.5	Low----------	0.24			
	37-60	---	---	0.06-2.0	---	---	----------	----			
DrB----------	0-9	10-22	1.10-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	5	5	2-3
Doritty	9-12	10-20	1.20-1.50	0.6-2.0	0.20-0.22	4.5-7.3	Low----------	0.43			
	12-18	15-25	1.20-1.55	0.6-2.0	0.20-0.22	4.5-6.5	Low----------	0.43			
	18-38	18-27	1.20-1.60	0.6-2.0	0.20-0.22	4.5-6.5	Low----------	0.43			
	38-60	10-25	1.20-1.50	0.6-2.0	0.20-0.22	4.5-6.5	Low----------	0.43			
Fm----------	0-8	10-23	1.35-1.45	0.6-2.0	0.17-0.24	4.5-8.4	Low----------	0.32	4	8	4-12
Fordum	8-27	8-17	1.40-1.50	0.6-6.0	0.10-0.22	4.5-8.4	Low----------	0.37			
	27-60	2-5	1.55-1.70	>6.0	0.04-0.10	5.6-8.4	Low----------	0.15			
FnB----------	0-7	5-17	1.25-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	5	5	1-3
Freeon	7-19	5-17	1.30-1.60	0.6-2.0	0.18-0.22	4.5-7.3	Low----------	0.43			
	19-39	7-17	1.70-1.80	0.06-0.6	0.08-0.18	4.5-6.5	Low----------	0.28			
	39-85	3-14	1.70-1.80	0.06-0.6	0.08-0.18	4.5-6.5	Low----------	0.28			
	85-99	3-14	1.80-1.95	0.01-0.06	0.0-0.4	5.1-7.3	Low----------	0.28			

Table 18.--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
FnC2----------	0-7	5-17	1.25-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.43	5	5	1-3
Freeon	7-19	5-17	1.30-1.60	0.6-2.0	0.18-0.22	4.5-7.3	Low----------	0.43			
	19-39	7-17	1.70-1.80	0.06-0.6	0.08-0.18	4.5-6.5	Low----------	0.28			
	39-85	3-14	1.70-1.80	0.06-0.6	0.08-0.18	4.5-6.5	Low----------	0.28			
	85-99	3-14	1.80-1.95	0.01-0.06	0.0-0.4	5.1-7.3	Low----------	0.28			
FrA----------	0-9	3-8	1.50-1.65	6.0-20	0.08-0.12	4.5-7.3	Low----------	0.10	5	2	.5-2
Friendship	9-16	2-7	1.35-1.65	6.0-20	0.05-0.11	4.5-6.5	Low----------	0.15			
	16-27	0-4	1.50-1.65	6.0-20	0.05-0.08	4.5-7.3	Low----------	0.15			
	27-60	0-4	1.50-1.70	6.0-20	0.04-0.07	5.1-7.8	Low----------	0.15			
Gr----------	0-12	---	0.30-0.40	>6.0	0.55-0.65	3.6-4.4	----------	----	3	7	55-75
Greenwood	12-60	---	0.10-0.25	0.6-6.0	0.45-0.55	3.6-4.4	----------	----			
HaB, HaC----------	0-4	6-14	1.40-1.65	0.6-2.0	0.11-0.15	4.5-7.3	Low----------	0.24	5	3	1-3
Haugen	4-23	4-14	1.40-1.70	0.6-2.0	0.12-0.19	4.5-7.3	Low----------	0.24			
	23-35	4-14	1.40-1.70	0.6-2.0	0.12-0.19	4.5-6.5	Low----------	0.24			
	35-79	7-17	1.40-1.70	0.2-2.0	0.06-0.14	4.5-6.5	Low----------	0.24			
	79-88	6-17	1.80-1.90	0.01-0.06	0.11-0.13	5.1-6.5	Low----------	0.24			
HgC:											
Haugen----------	0-4	6-14	1.40-1.65	0.6-2.0	0.11-0.15	4.5-7.3	Low----------	0.24	5	3	1-3
	4-23	4-14	1.40-1.70	0.6-2.0	0.12-0.19	4.5-7.3	Low----------	0.24			
	23-35	4-14	1.40-1.70	0.6-2.0	0.12-0.19	4.5-6.5	Low----------	0.24			
	35-79	7-17	1.40-1.70	0.2-2.0	0.06-0.14	4.5-6.5	Low----------	0.24			
	79-88	6-17	1.80-1.90	0.01-0.06	0.11-0.13	5.1-6.5	Low----------	0.24			
Greenwood-------	0-12	---	0.30-0.40	>6.0	0.55-0.65	3.6-4.4	----------	----	3	7	55-75
	12-60	---	0.10-0.25	0.6-6.0	0.45-0.55	3.6-4.4	----------	----			
HvC2----------	0-8	7-15	1.35-1.70	0.6-6.0	0.16-0.18	4.5-7.3	Low----------	0.32	3	3	1-2
Hayriver	8-13	5-12	1.40-1.70	0.6-6.0	0.12-0.17	4.5-7.3	Low----------	0.24			
	13-30	9-17	1.40-1.75	0.6-6.0	0.12-0.18	4.5-6.0	Low----------	0.24			
	30-60	---	---	0.06-2.0	---	---	----------	----			
HvD----------	0-8	7-15	1.35-1.70	0.6-6.0	0.16-0.18	4.5-7.3	Low----------	0.28	3	3	1-2
Hayriver	8-13	5-12	1.40-1.70	0.6-6.0	0.12-0.17	4.5-7.3	Low----------	0.24			
	13-30	9-17	1.40-1.75	0.6-6.0	0.12-0.18	4.5-6.0	Low----------	0.24			
	30-60	---	---	0.06-2.0	---	---	----------	----			
HyB----------	0-8	7-15	1.35-1.65	0.6-2.0	0.20-0.22	4.5-7.3	Low----------	0.32	3	5	1-2
Hayriver	8-13	5-12	1.40-1.70	0.6-6.0	0.12-0.17	4.5-7.3	Low----------	0.24			
	13-30	9-17	1.40-1.75	0.6-6.0	0.12-0.18	4.5-6.0	Low----------	0.24			
	30-60	---	---	0.06-2.0	---	---	----------	----			
HzF:											
Hayriver--------	0-8	7-15	1.35-1.70	0.6-6.0	0.16-0.18	4.5-7.3	Low----------	0.28	3	3	1-2
	8-13	5-12	1.40-1.70	0.6-6.0	0.12-0.17	4.5-7.3	Low----------	0.24			
	13-30	9-17	1.40-1.75	0.6-6.0	0.12-0.18	4.5-6.0	Low----------	0.24			
	30-60	---	---	0.06-2.0	---	---	----------	----			
Twinmound-------	0-4	2-4	1.40-1.65	6.0-20	0.06-0.09	3.6-7.3	Low----------	0.02	3	1	.5-1
	4-28	2-6	1.45-1.70	6.0-20	0.04-0.10	3.6-7.3	Low----------	0.15			
	28-42	---	---	0.2-2.0	---	---	----------	----			
	42-46	---	---	0.2-2.0	---	---	----------	----			
MaB----------	0-8	7-17	1.35-1.55	0.6-2.0	0.18-0.24	3.6-7.3	Low----------	0.37	5	5	1-3
Magnor	8-18	7-17	1.55-1.65	0.6-2.0	0.17-0.22	3.6-6.0	Low----------	0.43			
	18-24	7-17	1.55-1.65	0.6-2.0	0.17-0.22	3.6-6.0	Low----------	0.43			
	24-50	7-17	1.70-1.80	0.06-0.6	0.08-0.18	5.1-6.5	Low----------	0.20			
	50-60	3-14	1.80-1.95	0.01-0.06	0.0-0.04	5.1-6.5	Low----------	0.28			

Table 18.--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
Me	0-44	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8			2	2	55-85
Markey	44-60	0-10	1.40-1.65	6.0-20	0.03-0.08	5.6-8.4	Low				
Mh	0-5	4-10	1.35-1.65	2.0-6.0	0.10-0.12	3.5-7.3	Low	0.10	5	2	.5-3
Meehan	5-28	4-9	1.60-1.70	6.0-20	0.06-0.11	3.5-6.5	Low	0.15			
	28-60	1-4	1.60-1.70	6.0-20	0.02-0.07	5.1-7.3	Low	0.15			
MnA, MnB, MnC, MnD	0-12	2-10	1.20-1.50	6.0-20	0.10-0.12	4.5-6.5	Low	0.10	5	2	.5-2
Menahga	12-32	0-5	1.50-1.65	6.0-20	0.05-0.07	4.5-6.5	Low	0.15			
	32-60	0-5	1.50-1.65	6.0-20	0.05-0.07	5.6-7.8	Low	0.15			
Mo	0-4	10-15	1.40-1.70	0.6-6.0	0.13-0.22	3.6-6.0	Low	0.28	4	3	2-3
Moppet	4-10	8-17	1.45-1.70	0.6-6.0	0.15-0.22	3.6-6.0	Low	0.24			
	10-39	8-17	1.45-1.70	0.6-6.0	0.15-0.22	3.6-6.0	Low	0.24			
	39-60	2-10	1.60-1.75	6.0-20	0.03-0.09	3.6-6.5	Low	0.10			
NeB, NeC	0-3	6-15	1.35-1.70	0.6-2.0	0.12-0.18	4.5-7.3	Low	0.24	4	3	1-3
Newood	3-11	6-15	1.35-1.70	0.6-2.0	0.09-0.19	4.5-6.0	Low	0.17			
	11-40	6-15	1.40-1.70	0.6-2.0	0.06-0.17	4.5-6.5	Low	0.20			
	40-64	10-17	1.80-2.05	0.06-0.2	0.08-0.10	4.5-6.5	Low	0.20			
	64-80	7-17	1.80-2.05	<0.06	0.0-0.04	5.1-6.5	Low	0.28			
NoD	0-4	2-15	1.35-1.70	0.6-2.0	0.12-0.18	3.6-7.3	Low	0.24	4	3	1-3
Newot	4-21	2-17	1.35-1.70	0.6-2.0	0.09-0.19	4.5-5.5	Low	0.20			
	21-41	2-17	1.40-1.70	0.6-2.0	0.06-0.17	4.5-6.0	Low	0.20			
	41-62	7-17	1.80-2.05	0.06-0.2	0.08-0.10	5.1-6.5	Low	0.20			
	62-80	6-17	1.80-2.05	<0.06	0.0-0.04	5.1-6.5	Low	0.28			
Ns	0-8	4-12	1.35-1.65	2.0-6.0	0.08-0.13	3.5-7.3	Low	0.10	5	2	4-10
Newson	8-28	1-4	1.70-1.80	6.0-20	0.05-0.11	3.5-5.5	Low	0.17			
	28-60	1-4	1.70-1.80	6.0-20	0.04-0.11	4.5-6.5	Low	0.15			
Oe	0-8	8-15	1.40-1.70	0.6-6.0	0.10-0.18	4.5-6.5	Low	0.24	4	3	2-3
Oesterle	8-11	8-15	1.40-1.70	0.6-6.0	0.09-0.20	4.5-6.5	Low	0.24			
	11-25	7-17	1.40-1.70	0.6-6.0	0.05-0.18	4.5-6.5	Low	0.24			
	25-60	1-6	1.50-1.75	>6.0	0.01-0.07	5.1-6.5	Low	0.10			
OsC2	0-9	9-17	1.20-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.43	5	5	2-4
Otterholt	9-26	9-20	1.50-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	26-41	18-25	1.50-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	41-45	10-20	1.55-1.75	0.2-2.0	0.07-0.16	5.1-6.5	Low	0.32			
	45-60	8-16	1.70-1.85	0.2-2.0	0.05-0.15	5.1-6.5	Low	0.28			
OsD	0-9	9-17	1.20-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	5	5	2-4
Otterholt	9-26	9-20	1.50-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	26-41	18-25	1.50-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	41-45	10-20	1.55-1.75	0.2-2.0	0.07-0.16	5.1-6.5	Low	0.32			
	45-60	8-16	1.70-1.85	0.2-2.0	0.05-0.15	5.1-6.5	Low	0.28			
Pc. Pits											
PdB, PdC, PdD	0-9	5-15	1.35-1.60	6.0-20	0.07-0.12	3.6-7.3	Low	0.10	3	2	1-3
Plainbo	9-35	1-10	1.45-1.65	6.0-20	0.04-0.11	3.6-6.5	Low	0.15			
	35-60	---	---	0.2-2.0	---	---					

Table 18.--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
Px----------	0-9	13-17	1.35-1.55	0.6-2.0	0.21-0.24	4.5-7.3	Low----------	0.37	4	5	2-4
Poskin	9-12	10-15	1.55-1.65	0.6-2.0	0.17-0.22	4.5-6.5	Low----------	0.43			
	12-19	15-22	1.55-1.65	0.6-2.0	0.17-0.22	4.5-6.5	Low----------	0.43			
	19-36	18-27	1.55-1.65	0.6-2.0	0.17-0.22	4.5-6.5	Low----------	0.43			
	36-39	2-15	1.40-1.65	0.6-6.0	0.05-0.22	4.5-6.5	Low----------	0.24			
	39-60	0-3	1.75-1.85	>6.0	0.02-0.07	4.5-6.5	Low----------	0.10			
QuA----------	0-13	10-17	1.25-1.35	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.32	5	5	3-8
Quarderer	13-22	10-17	1.25-1.40	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.43			
	22-29	10-17	1.25-1.35	0.6-2.0	0.22-0.24	4.5-6.0	Low----------	0.28			
	29-55	10-20	1.30-1.45	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.43			
	55-72	10-15	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.43			
Rb----------	0-8	10-20	1.25-1.35	0.6-2.0	0.22-0.28	5.1-7.3	Low----------	0.32	4	5	3-10
Rib	8-32	18-30	1.45-1.55	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.43			
	32-36	5-25	1.45-1.75	0.6-6.0	0.10-0.19	5.1-7.3	Low----------	0.32			
	36-60	1-6	1.75-1.85	>6.0	0.02-0.06	5.6-7.8	Low----------	0.10			
RhC, RhE----------	0-3	6-18	1.30-1.55	0.6-2.0	0.15-0.17	4.5-6.0	Low----------	0.32	2	8	6-10
Ribhill	3-17	6-18	1.40-1.60	0.6-2.0	0.12-0.15	4.5-6.0	Low----------	0.32			
	17-38	6-18	1.55-1.65	0.6-2.0	0.02-0.14	4.5-6.0	Low----------	0.32			
	38-42	---	---	0.01-20	---	---	----------	----			
RoA, RoB, RoC2---	0-8	7-13	1.50-1.60	0.6-2.0	0.16-0.24	4.5-7.3	Low----------	0.32	4	5	1-3
Rosholt	8-11	3-12	1.70-1.80	0.6-6.0	0.10-0.22	4.5-6.5	Low----------	0.24			
	11-32	6-15	1.65-1.75	0.6-6.0	0.09-0.19	4.5-6.5	Low----------	0.24			
	32-36	4-12	1.55-1.65	0.6-6.0	0.04-0.16	4.5-6.5	Low----------	0.10			
	36-60	0-5	1.50-1.80	>6.0	0.02-0.04	5.1-6.5	Low----------	0.10			
Ru.											
Rubble land											
SaB----------	0-10	5-15	1.20-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.37	5	5	1-3
Santiago	10-15	5-14	1.40-1.60	0.6-2.0	0.20-0.23	4.5-6.5	Low----------	0.43			
	15-23	7-17	1.45-1.65	0.6-2.0	0.17-0.22	4.5-6.5	Low----------	0.43			
	23-87	7-17	1.65-1.75	0.06-0.6	0.09-0.18	4.5-6.5	Low----------	0.24			
	87-99	3-14	1.80-1.95	0.01-0.06	0.0-0.04	5.1-7.3	Low----------	0.28			
SaC2, SaD2-------	0-10	5-15	1.20-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.43	5	5	1-3
Santiago	10-15	5-14	1.40-1.60	0.6-2.0	0.20-0.23	4.5-6.5	Low----------	0.43			
	15-23	7-17	1.45-1.65	0.6-2.0	0.17-0.22	4.5-6.5	Low----------	0.43			
	23-87	7-17	1.65-1.75	0.06-0.6	0.09-0.18	4.5-6.5	Low----------	0.24			
	87-99	3-14	1.80-1.95	0.01-0.06	0.0-0.04	5.1-7.3	Low----------	0.28			
ScA----------	0-9	6-15	1.35-1.70	0.6-2.0	0.10-0.15	4.5-7.3	Low----------	0.24	4	5	2-3
Scoba	9-16	6-15	1.40-1.70	0.6-2.0	0.06-0.19	4.5-6.5	Low----------	0.32			
	16-26	8-17	1.40-1.70	0.6-2.0	0.06-0.22	4.5-6.5	Low----------	0.24			
	26-31	2-12	1.45-1.70	6.0-20	0.02-0.11	4.5-6.5	Low----------	0.17			
	31-60	1-6	1.50-1.80	>6.0	0.01-0.08	4.5-7.3	Low----------	0.10			
Sm:											
Seelyeville-----	0-8	---	0.10-0.25	0.2-6.0	0.35-0.45	4.5-7.3	----------	----	3	2	25-99
	8-60	---	0.10-0.25	0.2-6.0	0.35-0.45	4.5-7.3	----------	----			
Cathro----------	0-16	---	0.28-0.45	0.2-6.0	0.35-0.45	4.5-7.8	----------	----	2	2	60-85
	16-30	---	0.15-0.30	0.2-6.0	0.35-0.45	4.5-7.8	----------	0.24			
	30-60	10-30	1.50-1.70	0.6-2.0	0.11-0.22	5.6-8.4	Low----------	0.32			

Table 18.--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
SoA	0-8	6-15	1.20-1.55	0.6-2.0	0.20-0.22	4.5-7.3	Low	0.43	3	5	1-3
Siouxcreek	8-14	6-15	1.40-1.65	0.6-2.0	0.10-0.19	4.5-6.0	Low	0.32			
	14-32	7-17	1.50-1.70	0.6-2.0	0.10-0.19	4.5-6.0	Low	0.32			
	32-38	2-7	1.50-1.70	2.0-20	0.04-0.11	4.5-6.0	Low	0.15			
	38-60	---	---	0.2-2.0	---	---		----			
SrB	0-9	9-17	1.20-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	5	5	2-4
Spencer	9-12	9-17	1.30-1.60	0.6-2.0	0.20-0.24	4.5-6.0	Low	0.43			
	12-30	18-25	1.50-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	30-42	18-25	1.50-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	42-48	10-20	1.55-1.75	0.6-2.0	0.07-0.16	5.1-6.5	Low	0.32			
	48-72	10-20	1.70-1.85	0.2-2.0	0.05-0.15	5.1-6.5	Low	0.28			
SrC2	0-9	9-17	1.20-1.55	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.43	5	5	2-4
Spencer	9-12	9-17	1.30-1.60	0.6-2.0	0.20-0.24	4.5-6.0	Low	0.43			
	12-30	18-25	1.50-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	30-42	18-25	1.50-1.65	0.6-2.0	0.18-0.22	4.5-6.0	Moderate	0.43			
	42-48	10-20	1.55-1.75	0.6-2.0	0.07-0.16	5.1-6.5	Low	0.32			
	48-72	10-20	1.70-1.85	0.2-2.0	0.05-0.15	5.1-6.5	Low	0.28			
Ud	0-60	5-50	---	---	---	---		----	---	---	---
Udorthents											
Va	0-16	15-25	1.35-1.55	0.6-2.0	0.22-0.24	5.1-6.5	Low	0.32	5	5	3-10
Vancecreek	16-49	18-27	1.35-1.55	0.6-2.0	0.20-0.22	5.1-6.5	Low	0.43			
	49-60	8-27	1.55-1.65	0.6-2.0	0.20-0.22	5.1-7.8	Low	0.43			
WkC2, WkD2	0-10	10-22	1.10-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.43	5	5	2-3
Wickware	10-17	15-25	1.20-1.55	0.6-2.0	0.20-0.22	4.5-6.5	Low	0.43			
	17-36	18-27	1.20-1.60	0.6-2.0	0.20-0.22	4.5-6.5	Low	0.43			
	36-60	10-25	1.20-1.50	0.6-2.0	0.20-0.22	4.5-6.5	Low	0.43			

Table 19.--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			
Ad Adolph	B/D	None	---	---	+1-0	Perched	Oct-Jun	>60	---	---	High	High	Moderate.
AfA Aftad	B	None	---	---	2.5-3.5	Perched	Sep-Jun	>60	---	---	Moderate	Low	Moderate.
AhA Almena	C	None	---	---	1.0-2.5	Perched	Oct-Jun	>60	---	---	High	Low	Moderate.
AlD Amery	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Low	High.
AmD:													
Amery	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Low	High.
Greenwood	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	High	High	High.
AnA, AnB, AnC2 Anigon	B	None	---	---	>6.0	---	---	>60	---	---	High	Moderate	Moderate.
ApB, ApC2, ApD, AsB, AsC2 Arland	B	None	---	---	>6.0	---	---	20-40	Soft	---	Low	Moderate	Moderate.
Au Auburndale	B/D	None	---	---	+1-1.0	Perched	Sep-Jun	>60	---	---	High	High	Moderate.
Ba Barronett	B/D	Rare	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	High	Moderate	High.
Be Beseman	A/D	None	---	---	+2-0	Apparent	Jan-Dec	>60	---	12-36	High	High	High.
BpA Brill	B	None	---	---	>6.0	---	---	>60	---	---	High	Moderate	Moderate.
CaC2 Campia	B	None	---	---	>6.0	---	---	>60	---	---	High	Moderate	Moderate.
Cb Capitola	B/D	None	---	---	+1-1.0	Perched	Sep-Jun	>60	---	---	High	High	High.

Table 19.--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			
CkA, CkB, CkC2--Chetek	B	None	---	---	>6.0	---	---	>60	---	---	Low	Low	High.
ClD:													
Chetek	B	None	---	---	>6.0	---	---	>60	---	---	Low	Low	High.
Rosholt	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Low	Moderate.
Cm--Comstock	C	None	---	---	1.0-2.5	Perched	Sep-Jun	>60	---	---	High	Moderate	High.
CsC, CsD:													
Cress	A	None	---	---	>6.0	---	---	>60	---	---	Low	Low	Moderate.
Mahtomedi	A	None	---	---	>6.0	---	---	>60	---	---	Low	Low	High.
CuA, CuB--Crystal Lake	B	None	---	---	2.5-3.5	Perched	Sep-Jun	>60	---	---	High	Low	High.
DoB, DoC2, DoD2--Dobie	B	None	---	---	>6.0	---	---	20-40	Soft	---	High	Moderate	Moderate.
DrB--Doritty	B	None	---	---	3.5-6.0	Perched	Oct-Jun	>60	---	---	High	Low	Moderate.
Fm--Fordum	D	Frequent	Brief or long.	Mar-Jun	+1-1.0	Apparent	Jan-Dec	>60	---	---	High	High	High.
FnB, FnC2--Freeon	C	None	---	---	2.0-3.5	Perched	Nov-May	>60	---	---	Moderate	Low	Moderate.
FrA--Friendship	A	None	---	---	3.5-6.0	Apparent	Oct-Jun	>60	---	---	Low	Low	High.
Gr--Greenwood	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	High	High	High.
HaB, HaC--Haugen	B	None	---	---	2.5-3.5	Perched	Sep-Jun	>60	---	---	Moderate	Moderate	High.
HgC:													
Haugen	B	None	---	---	2.5-3.5	Perched	Sep-Jun	>60	---	---	Moderate	Moderate	High.
Greenwood	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	High	High	High.

Table 19.--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			
HvC2, HvD, HyB--Hayriver	B	None	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Low	Moderate.
HzF:													
Hayriver	B	None	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Low	Moderate.
Twinmound	A	None	---	---	>6.0	---	---	20-40	Soft	---	Low	Low	High.
MaB--Magnor	C	None	---	---	1.0-2.5	Perched	Sep-Jun	>60	---	---	High	Low	Moderate.
Me--Markey	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	25-30	High	High	Low.
Mh--Meehan	B	None	---	---	1.0-2.5	Apparent	Oct-Jun	>60	---	---	Moderate	Low	Moderate.
MnA, MnB, MnC, MnD--Menahga	A	None	---	---	>6.0	---	---	>60	---	---	Low	Low	Moderate.
Mo--Moppet	B	Occasional	Very brief	Sep-Jun	2.5-3.5	Apparent	Sep-Jun	>60	---	---	Moderate	Moderate	Moderate.
NeB, NeC--Newood	C	None	---	---	2.5-3.5	Perched	Oct-May	>60	---	---	Moderate	Moderate	High.
NoD--Newot	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Low	High.
Ns--Newson	A/D	Occasional	Brief	Apr-Jun	+1-1.0	Apparent	Oct-Jun	>60	---	---	Moderate	High	High.
Oe--Oesterle	C	None	---	---	1.0-2.5	Apparent	Oct-Jun	>60	---	---	High	Low	Moderate.
OsC2, OsD--Otterholt	B	None	---	---	>6.0	---	---	>60	---	---	High	Low	High.
Pc. Pits													
PdB, PdC, PdD--Plainbo	A	None	---	---	>6.0	---	---	20-40	Soft	---	Low	Low	Moderate.

Table 19.--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			
Px---------- Poskin	C	None--------	---	---	1.0-2.5	Apparent	Oct-Jun	>60	---	---	High-----	Low------	Moderate.
QuA---------- Quarderer	B	Occasional	Very brief or brief.	Nov-Jun	3.5-6.0	Apparent	Oct-Jun	>60	---	---	High-----	Moderate	High.
Rb---------- Rib	B/D	Occasional	Very brief or brief.	Oct-Jun	+1-1.0	Apparent	Oct-Jun	>60	---	---	High-----	High-----	High.
RhC, RhE---- Ribhill	B	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Low------	Moderate.
RoA, RoB, RoC2-- Rosholt	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	Moderate.
Ru. Rubble land													
SaB, SaC2, SaD2- Santiago	C	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	High.
ScA---------- Scoba	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	High.
Sm: Seelyeville----	A/D	None--------	---	---	+1-0.5	Apparent	Oct-Jun	>60	---	50-55	High-----	High-----	Moderate.
Cathro---------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	19-22	High-----	High-----	Low.
SoA---------- Siouxcreek	C	None--------	---	---	1.0-2.5	Perched	Sep-Jun	20-40	Soft	---	Moderate	Moderate	High.
SrB, SrC2---- Spencer	B	None--------	---	---	2.5-3.5	Perched	Oct-Jun	>60	---	---	High-----	Low------	High.
Ud---------- Udorthents	B	None--------	---	---	---	---	---	>60	---	---	---	---	---
Va---------- Vancecreek	B/D	Frequent----	Very brief or brief.	Mar-Nov	+1-1.0	Apparent	Oct-Jun	>60	---	---	High-----	High-----	Low.
WkC2, WkD2---- Wickware	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	Low------	Moderate.

Table 20.--Engineering Index Test Data

(Dashes indicate that data were not available. LL means liquid limit; PI, plasticity index; UN, Unified; and NP, nonplastic)

Soil name and location	Parent material	Report number	Horizon	Depth	Percentage passing sieve*--				Percentage smaller than*--				LL	PI	Classification	
					No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	UN
				In									Pct			
Amery sandy loam:	Loamy glacial	S90WI-005-														
NW1/4NE1/4 sec.	mudflow	3-2	Bw1	2-13	79	74	60	26	22	13	6	4	16.6	NP	A-2-4(0)	SM
29, T. 36 N.,	sediment and	3-6	B/E	49-92	89	84	69	28	23	15	9	6	13.6	NP	A-2-4(0)	SM
R. 10 W.	dense sandy loam glacial till.	3-8	Cd	92-119	90	85	69	29	25	17	12	8	16.3	NP	A-2-4(0)	SM
Chetek sandy loam:	Loamy alluvium and sandy outwash.	S88WI-005-														
SE1/4NE1/4 sec.		2-1	Bt1	10-16	95	89	63	36	32	23	14	11	27.1	12.2	A-6(1)	CL
15, T. 35 N.,		2-2	2Bt2	16-19	97	91	55	18	16	12	7	6	---	NP	A-2-4(0)	SM
R. 11 W.																
Freeon silt loam:	Silty deposits and dense loamy glacial till.	S87WI-005-														
NE1/4NW1/4 sec.		8-4	Bt1	17-23	95	95	90	77	72	48	17	11	20.4	1.4	A-4(8)	CL
26, T. 34 N.,		8-5	2Bt2	23-31	79	74	59	27	23	16	9	6	19.4	4.8	A-2-4(0)	SC
R. 10 W.		8-6	2Cd	31-60	93	91	78	41	37	27	16	12	23.3	9.7	A-4(1)	SC
Freeon silt loam:	Silty deposits and dense loamy glacial till.	S87WI-005-														
SE1/4SE1/4 sec.		7-5	2Bt2	20-29	94	93	77	45	41	30	15	11	24.2	8.7	A-4(2)	SC
30, T. 35 N.,		7-6	2BC	29-36	93	89	79	31	27	17	8	5	---	NP	A-2-4(0)	SM
R. 11 W.		7-7	2Cd	36-60	91	88	74	28	24	19	14	10	---	NP	A-2-4(0)	SM
Freeon silt loam:	Silty deposits and dense loamy glacial till.	S90WI-005-														
SE1/4SE1/4 sec.		7-3	2B/E	19-39	91	89	77	25	18	11	7	6	14.1	NP	A-2-4(0)	SM
16, T. 33 N.,		7-4	2Bt1	39-53	96	94	79	28	25	18	13	10	15.2	NP	A-2-4(0)	SM
R. 12 W.		7-7	2Cd	85-100	97	95	81	29	26	15	10	6	13.6	NP	A-2-4(0)	SM
Haugen sandy loam:	Loamy glacial mudflow sediment and dense glacial till.	S90WI-005-														
NE1/4SW1/4 sec.		4-2	Bw1	4-15	92	89	72	32	29	19	9	5	17.2	NP	A-2-4(0)	SM
9, T. 30 N.,		4-7	Bt2	60-79	86	82	65	30	25	18	12	9	18.8	NP	A-2-4(0)	SM
R. 12 W.		4-8	Cd	79-88	91	87	30	28	22	13	7	5	15.4	NP	A-2-4(0)	SM
Magnor silt loam:	Silty deposits and sandy loam or loam glacial till.	S87WI-005-														
SE1/4SE1/4 sec.		9-4	B/E	20-26	100	100	96	88	81	51	22	16	28.7	7.3	A-4(8)	CL
22, T. 34 N.,		9-6	2Bt2	32-36	86	81	62	24	19	13	7	5	---	NP	A-2-4(0)	SM
R. 10 W.		9-7	2Cd	36-60	90	86	70	24	19	12	6	4	---	NP	A-2-4(0)	SM
Magnor silt loam:	Silty deposits and dense loamy glacial till.	S87WI-005-														
SE1/4NE1/4 sec.		10-6	2Bt2	20-25	91	87	70	34	29	19	11	10	23.6	7.4	A-2-4(0)	SC
29, T. 34 N.,		10-6	2Cd	25-60	90	87	73	30	26	18	12	10	---	NP	A-2-4(0)	SM
R. 10 W.																

See footnote at end of table.

Table 20.--Engineering Index Test Data--Continued

Soil name and location	Parent material	Report number	Horizon	Depth	Percentage passing sieve*-- No. 4	No. 10	No. 40	No. 200	Percentage smaller than*-- 0.05 mm	0.02 mm	0.005 mm	0.002 mm	LL	PI	Classification AASHTO	UN
				In									Pct			
Magnor silt loam: SE1/4NE1/4 sec. 22, T. 32 N., R. 14 W.	Silty deposits and dense loamy glacial till.	S90WI-005- 6-2	E/B	10-20	99	98	96	90	82	52	24	20	29.8	8.0	A-4(8)	CL
		6-4	2Bt1	24-44	92	88	71	33	28	21	13	9	17.9	3.7	A-2-4(0)	SM
		6-7	2Cd	76-86	88	84	71	35	31	23	16	14	21.2	6.8	A-4(0)	SM-SC
Plainbo loamy sand: SW1/4SE1/4 sec. 29, T. 32 N., R. 11 W.	Sandy eolian or alluvial deposits over sandstone.	S89WI-005- 8-2	Bw	9-16	97	97	78	15	14	11	8	6	---	NP	A-2-4(0)	SM
		8-4	C	21-35	100	100	77	6	5	5	4	3	---	NP	A-3(0)	SP-SM
Ribhill cobbly silt loam: NE1/4NW1/4 sec. 34, T. 35 N., R. 10 W.	Loess and loamy glacial till over quartzite.	S87WI-005- 12-4	Bt1	13-17	94	92	86	74	67	39	15	12	22.0	3.4	A-4(8)	ML
		12-5	2Bt2	17-23	93	92	81	59	53	34	18	15	27.5	10.5	A-4(5)	CL
		12-6	2Bt3	23-38	87	85	71	45	40	28	15	12	25.2	9.7	A-4(2)	SC
Santiago silt loam: SE1/4NW1/4 sec. 34, T. 32 N., R. 14 W.	Silty deposits and dense loamy glacial till.	S90WI-005- 8-3	2Bt1	15-23	90	86	72	34	28	19	9	6	16.0	NP	A-2-4(0)	SM
		8-5	2Bt2	36-49	96	94	78	31	27	20	14	11	16.2	NP	A-2-4(0)	SM
		8-8	2Cd	87-102	96	94	76	29	25	19	12	9	16.8	NP	A-2-4(0)	SM

* Mechanical analysis according to the AASHTO designation T 88-57 (AASHTO, 1986). 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 fraction. The mechanical analysis data used in this table are not suitable for use in naming textural classes of soils.

Table 21.--Classification of the Soils

Soil name	Family or higher taxonomic class
Adolph	Coarse-loamy, mixed, frigid Typic Epiaquolls
Aftad	Coarse-loamy, mixed Oxyaquic Glossoboralfs
Almena	Fine-silty, mixed Aquic Glossoboralfs
Amery	Coarse-loamy, mixed Typic Glossoboralfs
Anigon	Fine-silty over sandy or sandy-skeletal, mixed Typic Glossoboralfs
Arland	Coarse-loamy, mixed Typic Glossoboralfs
Auburndale	Fine-silty, mixed, frigid Mollic Epiaqualfs
Barronett	Fine-silty, mixed, frigid Mollic Endoaqualfs
Beseman	Loamy, mixed, dysic Terric Borosaprists
Brill	Fine-silty over sandy or sandy-skeletal, mixed Typic Glossoboralfs
Campia	Fine-silty, mixed Typic Glossoboralfs
Capitola	Coarse-loamy, mixed, frigid Mollic Epiaqualfs
Cathro	Loamy, mixed, euic Terric Borosaprists
Chetek	Coarse-loamy, mixed Eutric Glossoboralfs
Comstock	Fine-silty, mixed Aquic Glossoboralfs
Cress	Sandy, mixed, frigid Typic Dystrochrepts
Crystal Lake	Fine-silty, mixed Oxyaquic Glossoboralfs
Dobie	Fine-silty, mixed Typic Glossoboralfs
Doritty	Fine-silty, mixed Typic Glossoboralfs
Fordum	Coarse-loamy, mixed, nonacid, frigid Mollic Fluvaquents
Freeon	Coarse-loamy, mixed Oxyaquic Glossoboralfs
Friendship	Mixed, frigid Typic Udipsamments
Greenwood	Dysic Typic Borohemists
Haugen	Coarse-loamy, mixed Oxyaquic Glossoboralfs
Hayriver	Coarse-loamy, mixed Eutric Glossoboralfs
Magnor	Coarse-loamy, mixed Aquic Glossoboralfs
Mahtomedi	Mixed, frigid Typic Udipsamments
Markey	Sandy or sandy-skeletal, mixed, euic Terric Borosaprists
Meehan	Mixed, frigid Aquic Udipsamments
Menahga	Mixed, frigid Typic Udipsamments
Moppet	Coarse-loamy, mixed, frigid Oxyaquic Dystrochrepts
Newood	Coarse-loamy, mixed, frigid Oxyaquic Haplorthods
Newot	Coarse-loamy, mixed, frigid Alfic Haplorthods
Newson	Mixed, frigid Humaqueptic Psammaquents
Oesterle	Coarse-loamy, mixed Aquic Glossoboralfs
Otterholt	Fine-silty, mixed Typic Glossoboralfs
Plainbo	Mixed, frigid Typic Udipsamments
Poskin	Fine-silty over sandy or sandy-skeletal, mixed Aquic Glossoboralfs
Quarderer	Coarse-silty, mixed Fluventic Haploborolls
Rib	Fine-silty over sandy or sandy-skeletal, mixed, nonacid, frigid Mollic Endoaquepts
Ribhill	Loamy-skeletal, mixed Typic Glossoboralfs
Rosholt	Coarse-loamy, mixed Typic Glossoboralfs
Santiago	Coarse-loamy, mixed Typic Glossoboralfs
Scoba	Coarse-loamy, mixed Typic Glossoboralfs
Seelyeville	Euic Typic Borosaprists
Siouxcreek	Coarse-loamy over sandy or sandy-skeletal, mixed, frigid Aquic Hapludults
Spencer	Fine-silty, mixed Oxyaquic Glossoboralfs
Twinmound	Frigid, uncoated Typic Quartzipsamments
Udorthents	Udorthents
Vancecreek	Fine-silty, mixed, frigid Fluvaquentic Endoaquolls
Wickware	Fine-silty, mixed Typic Glossoboralfs

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