United States Department of Agriculture

Soil Conservation Service

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

Soil Survey of Waushara County, Wisconsin

How To Use This Soil Survey

General Soil Map

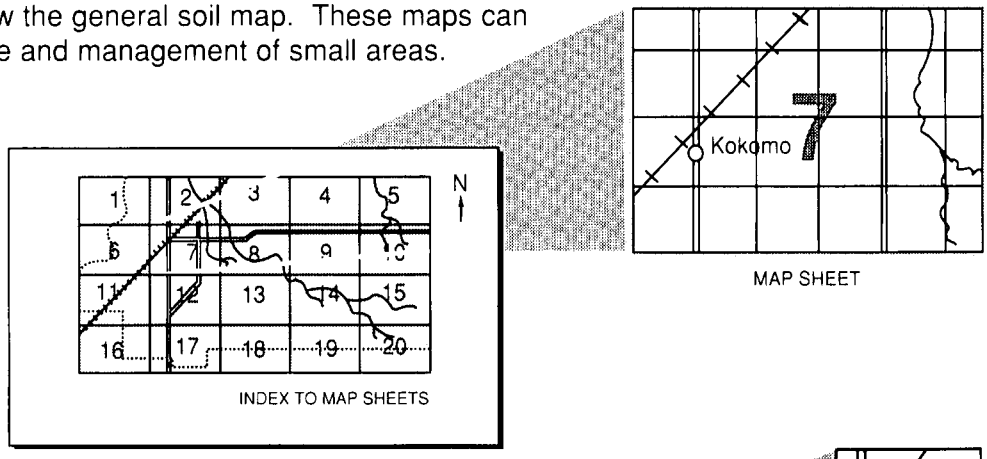
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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 follow the general soil map. These maps can be useful in planning the use and management of small areas.

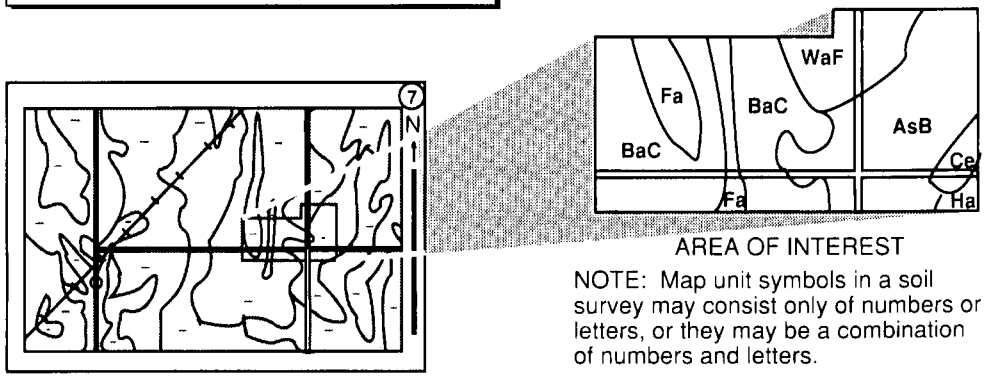
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

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



MAP SHEET

AREA OF INTEREST

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.

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

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

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Soil 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 Waushara County Land Conservation Committee, which helped to finance the fieldwork.

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

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: A plantation of Christmas trees in an area of Plainfield soils.

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Issued September 1989

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Summary of Tables

Foreword

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

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

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

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

Duane L. Johnson
State Conservationist
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Soil Survey of Waushara County, Wisconsin

By Augustine J. Otter, Fred J. Simeth, and Duane T. Simonson, Soil Conservation Service

Fieldwork by Augustine J. Otter, Fred J. Simeth, and Duane T. Simonson, Soil Conservation Service

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

WAUSHARA COUNTY is in the central part of Wisconsin (fig. 1). The total area is 408,122 acres, or about 638 square miles. Of this, 6,105 acres is water areas more than 40 acres in size.

The county has 2 cities, 6 villages, and 18 townships. The city of Wautoma is the county seat. The population of the county was 18,526 in 1980 *(14)*.

About 33 percent of the land area, or about 133,000 acres, is cropland. Of this, about 28 percent is irrigated. The major types of farming are dairying and vegetable farming. The principal crops are corn, alfalfa, snap beans, oats, peas, sweet corn, potatoes, and soybeans.

Waushara County is in the Central Plains Geographic Province of Wisconsin *(6)*. The soils are mainly light in color and are sandy and loamy. They formed under forest vegetation. Water erosion and soil blowing are the main management concerns in the county. Soils that have slopes of more than 1 or 2 percent are subject to erosion by water if they are not protected. Soils that have a sand, loamy sand, or sandy loam surface layer are subject to soil blowing if they are not protected. Many of the soils that have slopes of less than 2 percent are seasonally wet and require drainage for dependable crop production.

An older soil survey of Waushara County was published in 1913 *(15)*. This present survey updates the earlier one and provides additional information and

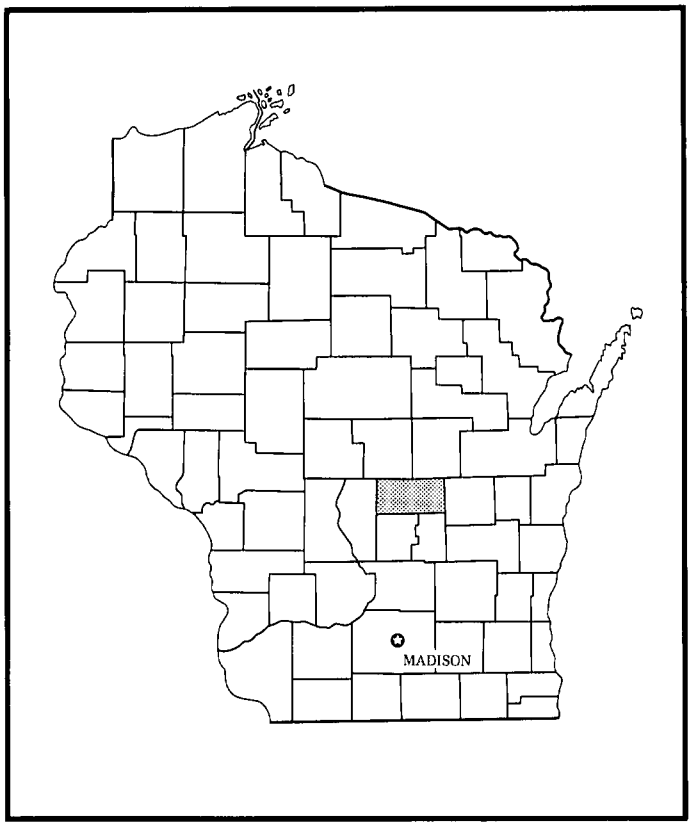

Figure 1.—Location of Waushara County in Wisconsin.

larger maps that show the soils in greater detail.

General Nature of the County

This section gives general information concerning the county. It describes history and development; climate; physiography, relief, and drainage; water supply; and transportation facilities and industry.

History and Development

The Menominee Indians lived in the area that was to become Waushara County for many years prior to the arrival of French explorers, missionaries, and fur traders in about 1748 *(3)*. Nearly 100 years passed before the first permanent white settlement was established in 1848. This settlement was formed by two brothers in the present-day township of Marion.

Immigration increased rapidly. By 1852, settlements were scattered all over the county. Because the county had not yet been surveyed, deeds or titles to the land could not be obtained. As a result, there were many disputes over land ownership.

Sawmills were established in the county around 1851. The first sawmill was established at Saxeville. Towns and villages soon formed around other sawmills. By 1880, wheat production was declining and potatoes had become an important crop. Dairying was increasing in importance. Cheese and butter companies were formed after 1880 but were relatively unsuccessful until about 1900.

Waushara County was established by an act of the Wisconsin State Legislature on February 15, 1851. Prior to that time the area had been a part of Marquette County. Several years later that part of Aurora Township that is south of the Fox River was added. This addition established the present boundaries of Waushara County. The first county seat was at Sacramento, but it was moved to Wautoma in 1854.

Since 1880, agriculture has been the single largest industry in Waushara County; however, recreation and industry are also important. Waushara County's landscape is interspersed with lakes, streams, and forests that are an attraction for tourists.

The first forest plantation in Wisconsin was planted in section 5 in the township of Hancock. Planting began in the year 1869 and was completed in 1876; most of this plantation still remains. Since 1876, much of the acreage has been planted to pines for Christmas trees, pulpwood, poles, and lumber.

Waushara County's population was 8,770 in 1860; 18,886 in 1910; 14,000 in 1950; 13,497 in 1960; 14,795 in 1970; and 18,526 in 1980. About 70 percent of the population is in unincorporated areas.

Climate

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

In Waushara County, winters are very cold and summers are fairly warm. Precipitation is fairly well distributed throughout the year, reaching a peak in summer. Snow covers the ground much of the time from late in fall to early in spring.

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

In winter, the average temperature is 17 degrees F and the average daily minimum temperature is 7 degrees. The lowest temperature on record, which occurred at Hancock on January 30, 1951, is -43 degrees. In summer, the average temperature is 68 degrees and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred at Hancock on August 21, 1955, 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 29.44 inches. Of this, 21 inches, or 71 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 4.14 inches at Hancock on September 12, 1978. Thunderstorms occur on about 34 days each year, and most occur in spring.

The average seasonal snowfall is about 45 inches. The greatest snow depth at any one time during the period of record was 38 inches. On the average, 60 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 45 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Physiography, Relief, and Drainage

Waushara County has a diverse landscape ranging from broad, flat outwash plains and lake basins to rough, broken glacial moraines and areas of pitted outwash. The western edge of the county is a flat outwash plain. A narrow moraine is on the eastern boundary of this plain and extends through the villages of Coloma, Hancock, and Plainfield. To the east of this moraine is a broad, gently rolling outwash plain that extends from the north county line to just north of Coloma. East of this plain is an area of drumlins and pitted outwash that has steep side slopes. To the east of the villages of Wild Rose, Wautoma, and Richford, this area gradually flattens into a rolling plain. The eastern one-third of the county is a gently rolling lake plain.

The highest elevation in the county, 1,285 feet, is on the moraine between Hancock and Plainfield. This moraine also forms the topographic divide between the Wisconsin River basin and the Fox River basin. The lowest elevation, 747 feet, is at the surface of Lake Poygan. Elevations of various cities and villages in the county are as follows: Coloma, 1,042 feet; Hancock, 1,088 feet; Redgranite, 792 feet; Wautoma, 897 feet; and Wild Rose, 997 feet.

Most of the county has a complex pattern of soil drainage. Scattered throughout the county are numerous areas of organic soils and many lakes. The most extensive area of organic soils is around Lake Poygan. Waushara County lies within three of Wisconsin's major watersheds—the Wisconsin River basin, the Fox River basin, and the Wolf River basin. All streams lying in the extreme western part of the county drain westerly to the Wisconsin River. Streams tributary to the Fox River flow out of the county in a southerly direction. Generally, Wolf River tributaries flow in an easterly direction.

Water Supply

Well water is available within the county at various depths, depending on the general topography. The capacity of a well is largely determined by the character of the underlying material. A good aquifer has many pores that are filled with ground water. Sandstone and deposits of sand and gravel are the best aquifers in Waushara County. The level of ground water can rise or fall from season to season and from year to year, depending on the amount of precipitation received.

The lower boundary of the ground water reservoir throughout the county is formed by the impermeable granitic bedrock that underlies the surface, generally at a depth of less than 400 feet. The only serious ground water problem in the county is in a few areas where the granite bedrock is near the surface *(9)*.

Ample supplies of water for irrigation are available at a relatively shallow depth in the western part of the county. The recharge rate is rapid in this area. Pumping for irrigation temporarily lowers the water level in the vicinity of wells in the area, but it has not yet lowered the regional water level.

In the central one-third of the county, the morainal deposits generally yield only enough water for domestic and livestock use. This is also true of the lake plain deposits in the eastern one-third of the county. This area also has numerous artesian wells.

The use of water from wells accounts only for a small part of the ground water discharge in the county. By far the largest discharge is into streams. The streams and lakes in the county generally can be considered as an exposure of the ground water. There are many miles of clear water streams and rivers. Nearly all of these are registered trout streams, which is an indication of the high quality of the water. Lakes formed in areas of pitted outwash, locally called kettle lakes, are scattered throughout the central part of the county and are important sites for water-associated recreation.

Transportation Facilities and Industry

The first means of transportation in the survey area consisted of boats and canoes on the Fox River. This is the means that most of the early settlers used to gain access to the area.

In 1849, the first road was built between Berlin and what is now known as Wautoma. Early travel in the county was difficult, and transportation routes consisted largely of horse and wagon trails. From 1850 to about 1880, railroads were built to connect most of the present cities and villages. These railroads provided a good transportation system for people and goods. It was during this period that numerous sawmills and gristmills were also built.

Waushara County has a well developed network of highways. This network consists of one federal highway and four state highways. Either a county or township highway is built on nearly every section line. Only a few

places are more than one-half mile from the nearest public road. The county is served by eight common carrier trucklines. All of the railroads have been abandoned. Commercial bus service is available throughout the county. Regular commercial air service is not available in the county.

The lumber industry at one time employed nearly all of the available workers. As the lumber industry declined, however, employment in the industry dropped to a level that included only a small percentage of the population. Other early industrial activities included quarrying stone, operating gristmills, producing wagons and harnesses, and other activities related to farming. Quarrying of granite ceased during the 1930's, but during the peak years it was the major industry. Abandoned quarries near Redgranite and Lohrville are evidence of this past activity. Present industries consist largely of food-processing plants and other industries related to farming. These industries are small, and they employ only a small percentage of the population.

How This Survey Was Made

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

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

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

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

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

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

table will always be at a specific level in the soil on a specific date.

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

Soil scientists were denied access to a few tracts in the county. These areas were mapped by using knowledge of the soils in the surrounding area and by aerial photo interpretation. Delineations portraying soil boundaries in these areas are less accurately drawn than in areas where soil scientists had access to the land and could examine the soils. These areas are identified on the map sheets by a dashed-line boundary and the notation "Area of Reduced Reliability."

The names of some of the soils do not agree with those of soils in surrounding counties because of changes in concepts of series and mapping criteria, the combination of components of minor extent, and differences in the proportions of soils within each county.

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

Some of the names of associations on the general soil map of Waushara County do not agree with those in surrounding counties because the extent of the major soils is different. The differences in the association names do not significantly affect the use of these maps for general planning.

Soil Descriptions

1. Plainfield-Okee-Richford Association

Sloping to steep, somewhat excessively drained and excessively drained, sandy soils; on moraines and terraces

This association is on the sides of ridges, knolls, and hills on moraines and terraces. Slopes range from 6 to 30 percent.

The association makes up about 35 percent of the county. It is about 40 percent Plainfield and similar soils, 15 percent Okee and similar soils, 10 percent Richford soils, and 35 percent soils of minor extent.

Plainfield soils are excessively drained. They are rapidly permeable. They are sloping to steep. Available water capacity is low. Typically, the surface layer is dark brown sand about 4 inches thick. The subsoil is strong brown sand about 15 inches thick. It is very friable in the upper part and loose in the lower part. The substratum to a depth of about 60 inches is light yellowish brown sand.

Okee soils are somewhat excessively drained. They are moderately permeable or moderately rapidly permeable. They are sloping and moderately steep. Available water capacity is low. Typically, the surface layer is very dark brown loamy sand about 2 inches thick. The subsoil extends to a depth of about 60 inches. It is strong brown, very friable sand in the upper part; brown, friable sandy loam in the next part; and brown, very friable loamy sand in the lower part.

Richford soils are somewhat excessively drained. They are moderately rapidly permeable in the upper part and rapidly permeable in the lower part. They are sloping and moderately steep. Available water capacity is low. Typically, the surface layer is very dark grayish brown loamy sand about 4 inches thick. The subsurface layer is dark yellowish brown sand about 18 inches thick. The subsoil is about 27 inches thick. It is dark brown. It is friable sandy loam in the upper part and very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand.

Minor in this association are the Houghton, Leola, Mecosta, and Meehan soils. The very poorly drained Houghton soils are in depressions. The somewhat poorly drained Leola and Meehan soils are in drainageways. The somewhat excessively drained Mecosta soils are on the sides of ridges and hills. Also of minor extent are small areas of the major soils that are on ridgetops and are nearly level or gently sloping.

Most of the acreage in this association is used as woodland; however, some areas are used for pasture. Some areas of the sloping Richford soils are used as cropland.

This association is generally not suited to use as cropland. It is suited to pine trees. The main

management concerns are the low available water capacity, the hazards of soil blowing and water erosion, and the equipment limitation caused by the slope. Trees should be planted on the contour. Skid roads should be properly located so that they do not increase the susceptibility to erosion.

Septic tank effluent drains satisfactorily in the sloping Plainfield and Richford soils, but it can pollute ground water. Because of the slope, the sloping Okee soils are only moderately suited to septic tank absorption fields. All of the moderately steep and steep soils are unsuited to this use.

2. Plainfield-Richford-Boyer Association

Nearly level and gently sloping, well drained to excessively drained, sandy soils; on outwash plains and terraces

This association is on flats, ridgetops, and knolls on outwash plains and terraces. Slopes range from 0 to 6 percent.

The association makes up about 21 percent of the county. It is about 30 percent Plainfield soils, 25 percent Richford soils, 10 percent Boyer soils, and 35 percent soils of minor extent.

Plainfield soils are excessively drained. They are rapidly permeable. They are nearly level and gently sloping. Available water capacity is low. Typically, the surface layer is dark brown sand about 7 inches thick. The subsoil is sand about 29 inches thick. It is brown and very friable in the upper part; strong brown and very friable in the next part; and brown and loose in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand.

Richford soils are somewhat excessively drained. They are moderately rapidly permeable in the upper part and rapidly permeable in the lower part. They are nearly level and gently sloping. Available water capacity is low. Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is dark yellowish brown sand about 18 inches thick. The subsoil is about 23 inches thick. It is dark brown. It is friable sandy loam in the upper part and very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand.

Boyer soils are well drained. They are moderately rapidly permeable in the subsoil and very rapidly permeable in the substratum. They are gently sloping. Available water capacity is low. Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsoil is about 14 inches thick. It is brown, very friable loamy sand in the upper part; brown, friable sandy loam in the next part; and strong brown, very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is light brownish gray, calcareous sand.

Minor in this association are the Kingsville, Leola, and Meehan soils. Kingsville soils are poorly drained and are in depressions. Leola and Meehan soils are somewhat poorly drained and are in drainageways. Also of minor extent are small areas of the major soils that are on side slopes and are sloping to steep.

Most of the acreage in this association is used as cropland. Many areas are used as irrigated cropland. The main management concerns are the low available water capacity and the hazard of soil blowing.

The major soils in this association are suited to trees.

Septic tank effluent drains satisfactorily in the major soils, but it can pollute ground water because of the rapid or very rapid permeability in the substratum.

3. Kingsville-Meehan Association

Nearly level and gently sloping, poorly drained and somewhat poorly drained, sandy soils; on outwash plains and in glacial lake basins

This association is in drainageways and depressions on outwash plains and in glacial lake basins. Slopes range from 0 to 3 percent.

The association makes up about 9 percent of the county. It is about 35 percent Kingsville soils, 30 percent Meehan soils, and 35 percent soils of minor extent (fig. 2).

Kingsville soils are poorly drained. They are rapidly permeable. They are nearly level. Available water capacity is low. Typically, the surface layer is black loamy sand about 7 inches thick. The next layer is very dark grayish brown and pale brown, very friable sand about 8 inches thick. The substratum to a depth of about 60 inches is grayish brown and pale brown sand.

Meehan soils are somewhat poorly drained. They are rapidly permeable. They are nearly level and gently sloping. Available water capacity is low. Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsoil is mottled, very friable sand about 25 inches thick. It is yellowish brown in the upper part and pale brown in the lower part. The substratum to a depth of about 60 inches is pale brown sand.

Minor in this association are the Adrian, Leola, and Plainfield soils. Adrian soils are very poorly drained. They are in depressions below the Kingsville soils. The somewhat poorly drained Leola soils are in

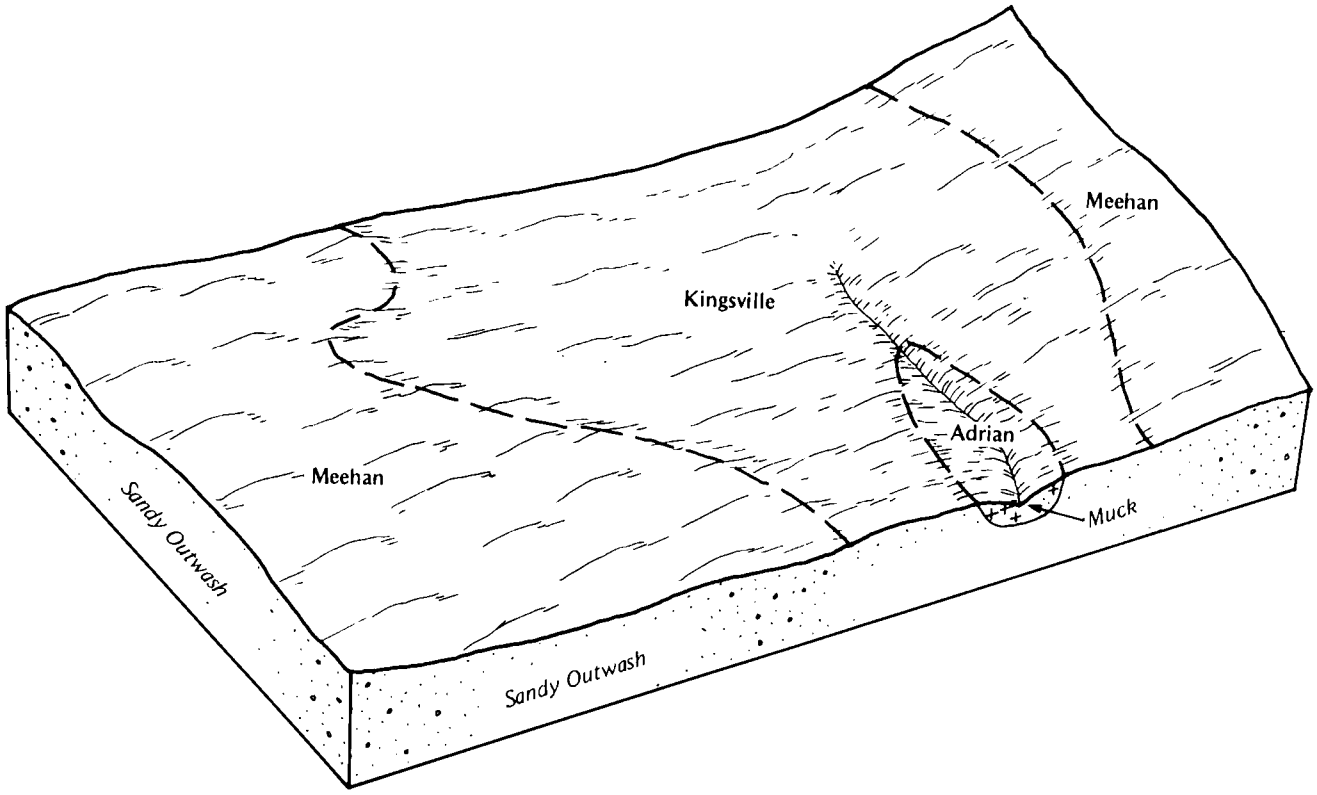

Figure 2.—Pattern of soils and parent material in the Kingsville-Meehan association.

drainageways. They are intermingled with areas of the Meehan soils. The excessively drained Plainfield soils are on flats on the higher parts of the landscape.

Most of the acreage in this association is used as cropland. Some areas are used as pasture or woodland. Many areas are drained and used as irrigated cropland. The main management concerns are wetness, the low available water capacity, and the hazard of soil blowing.

The Meehan soils are suited to trees, but the Kingsville soils are poorly suited this use. Wetness in the Kingsville soils during the planting season often limits reforestation to hand planting or natural regeneration. Seedling mortality is a limitation on both of the major soils. Planting vigorous nursery stock helps to overcome this limitation.

The Meehan soils are poorly suited to septic tank absorption fields because of wetness and a poor filtering capacity. The Kingsville soils generally are not suited to septic tank absorption fields because of wetness.

4. Houghton-Adrian-Willette Association

Nearly level, very poorly drained, mucky soils; on outwash plains, in glacial lake basins, and on moraines

This association is in depressions on outwash plains, in glacial lake basins, and on moraines. Slopes are 0 to 1 percent.

The association makes up about 15 percent of the county. It is about 35 percent Houghton soils, 30 percent Adrian soils, 5 percent Willette and similar soils, and 30 percent soils of minor extent.

Houghton soils are moderately slowly permeable to moderately rapidly permeable. Available water capacity is very high. Typically, these soils are black, very dark gray, and very dark brown muck about 60 inches thick.

Adrian soils are moderately slowly permeable to moderately rapidly permeable in the muck layer and are rapidly permeable in the substratum. Available water capacity is very high. Typically, the upper 32 inches is black muck. The substratum to a depth of about 60 inches is dark grayish brown and dark gray sand.

Willette soils are moderately slowly to moderately rapidly permeable in the muck layer and are slowly permeable in the substratum. Available water capacity is very high. Typically, the upper 31 inches is black muck. The substratum to a depth of about 60 inches is gray and brown, mottled, calcareous clay.

Minor in this association are the Keowns, Kingsville, Poy, and Poygan soils. These minor soils are poorly drained. They are in depressions slightly higher on the landscape than the major soils in this association.

Most of the acreage in this association is used for native vegetation. The main plants are water-tolerant trees, marsh grasses, cattails, sedges, reeds, redosier dogwood, and alder. A few areas are drained and are used for corn or specialty crops.

The main management concerns are wetness, subsidence when the soils are drained, and a short growing season caused by cold air flowing into depressions. The soft muck limits the use of farm equipment.

The major soils in this association are suited to trees. Wetness during the planting season often limits reforestation to hand planting or natural regeneration.

The major soils in this association are generally unsuited to use as septic tank absorption fields because of wetness and ponding.

5. Hortonville-Symco-Manawa Association

Nearly level to sloping, well drained and somewhat poorly drained, silty, loamy, and sandy soils; on moraines and in glacial lake basins

This association is on ridgetops and knolls, on the sides of ridges and knolls, and in drainageways on moraines and in glacial lake basins. Slopes range from 0 to 12 percent.

The association makes up about 8 percent of the county. It is about 30 percent Hortonville soils, 25 percent Symco soils, 10 percent Manawa soils, and 35 percent soils of minor extent (fig. 3).

Hortonville soils are well drained. They are moderately slowly permeable in the subsoil and moderately slowly permeable or slowly permeable in the substratum. They are gently sloping and sloping. Available water capacity is high. Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil is about 27 inches thick. It is reddish brown and firm. It is clay loam in the upper part and loam in the lower part. The substratum to a depth of about 60 inches is reddish brown, calcareous loam. In places, the surface layer is loam or the subsoil and substratum have more clay and less sand.

Symco soils are somewhat poorly drained. They are moderately slowly permeable. They are nearly level and gently sloping. Available water capacity is high. Typically, the surface layer is very dark grayish brown silt loam or loamy fine sand about 8 inches thick. The subsoil is mottled, firm clay loam about 20 inches thick. It is brown in the upper part and reddish brown in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled, calcareous loam.

Manawa soils are somewhat poorly drained. They are slowly permeable. They are nearly level and gently sloping. Available water capacity is moderate. Typically, the surface layer is black silt loam about 9 inches thick. The subsoil is about 20 inches thick. It is reddish brown, mottled, and firm. It is clay in the upper part and silty clay in the lower part. The substratum to a depth of about 60 inches is reddish brown, calcareous silty clay loam.

Minor in this association are the Nebago, Poygan, and Plainfield soils. The somewhat poorly drained Nebago soils are in drainageways. They are intermingled with areas of the Manawa soils. The poorly drained Poygan soils are in depressions. The excessively drained Plainfield soils are on ridges and knolls. They are intermingled with areas of the Hortonville soils.

Most of the acreage in this association is used as cropland. Some areas are used as pasture or woodland. The main management concerns are the hazard of water erosion on the Hortonville soils and wetness in the Symco and Manawa soils.

The major soils in this association are suited to trees.

The major soils in this association are poorly suited to septic tank absorption fields because of the moderately slow permeability in the Hortonville soils and the moderately slow or slow permeability and wetness in the Symco and Manawa soils.

6. Plainfield-Pearl-Leola Association

Nearly level and gently sloping, moderately well drained and somewhat poorly drained, sandy soils; on outwash plains

This association is on flats and in slight depressions and drainageways on outwash plains. Slopes range from 0 to 3 percent.

The association makes up about 6 percent of the county. It is about 40 percent Plainfield soils, 20 percent Pearl soils, 5 percent Leola soils, and 35 percent soils of minor extent.

Plainfield soils are moderately well drained. They are rapidly permeable. They are nearly level and gently

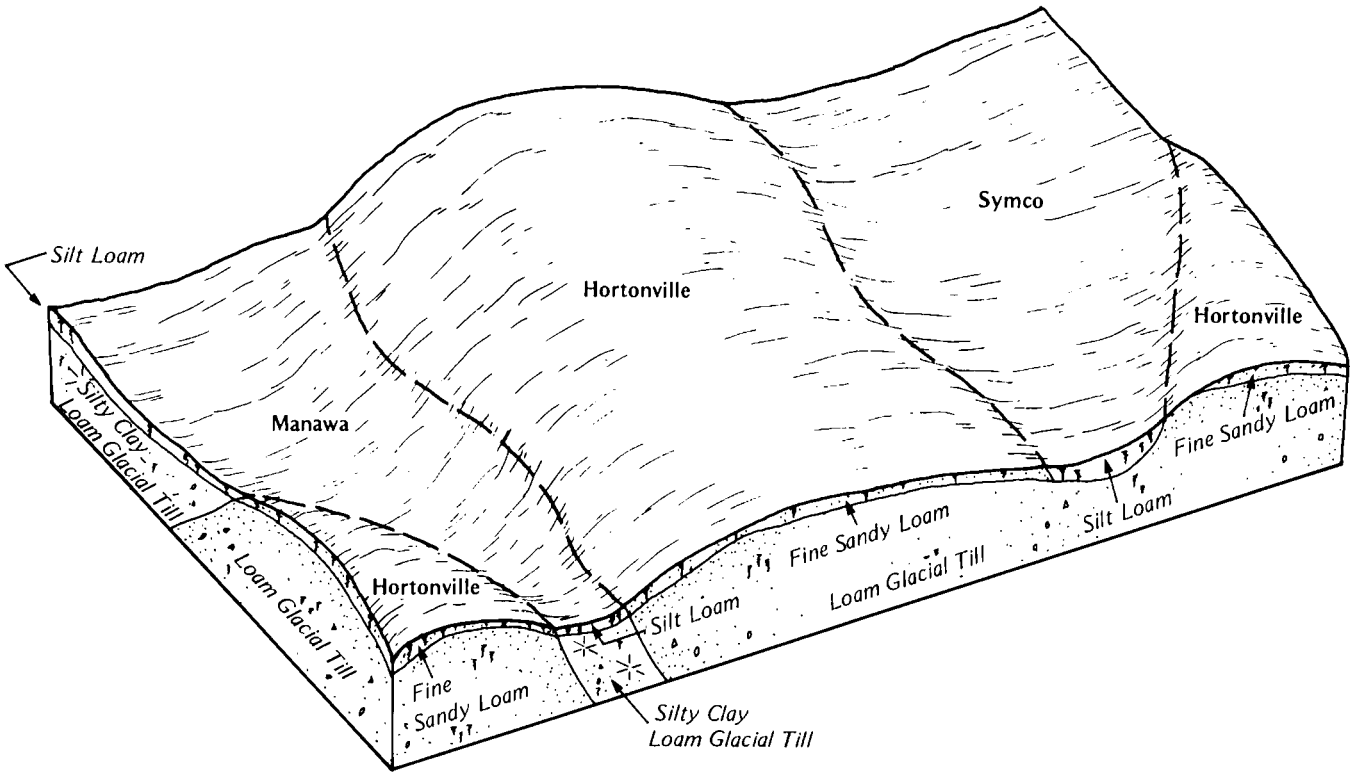

Figure 3.—Pattern of soils and parent material in the Hortonville-Symco-Manawa association.

sloping. Available water capacity is low. Typically, the surface layer is dark brown sand about 7 inches thick. The subsoil is strong brown sand about 14 inches thick. It is very friable in the upper part and loose in the lower part. The upper 32 inches of the substratum is brownish yellow sand. The lower part to a depth of about 60 inches is brownish yellow and light gray, mottled sand.

Pearl soils are moderately well drained. They are moderately rapidly permeable in the subsoil and rapidly permeable in the substratum. They are nearly level and gently sloping. Available water capacity is low. Typically, the surface layer is very dark brown loamy sand about 8 inches thick. The subsurface layer is brown sand about 28 inches thick. It is mottled in the lower part. The subsoil is about 8 inches thick. It is dark brown, mottled, and very friable. It is sandy loam in the upper part and loamy sand in the lower part. The substratum to a depth of about 60 inches is light brownish gray, mottled sand.

Leola soils are somewhat poorly drained. They are moderately rapidly permeable in the subsoil and rapidly permeable in the substratum. They are nearly level. Available water capacity is low. Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsoil is about 36 inches thick. It is very friable. It is yellowish brown, mottled loamy sand in the upper part; light brownish gray and strong brown loamy sand and sandy loam in the next part; and light brownish gray, mottled loamy sand in the lower part. The substratum to a depth of about 60 inches is light brownish gray and strong brown, mottled sand.

Minor in this association are the poorly drained Kingsville soils, somewhat poorly drained Meehan soils, excessively drained Plainfield soils, and somewhat excessively drained Richford soils. Kingsville soils are in depressions. Meehan soils are in drainageways. They are intermingled with areas of the Leola soils. Plainfield and Richford soils are on ridgetops and knolls.

Most of the acreage in this association is used as cropland. Many areas are used as irrigated cropland. Some areas are used as pasture or woodland. The main management concerns are the low available water capacity, the hazard of soil blowing, and the wetness, which affects some crops.

The major soils in this association are suited to trees.

The major soils in this association are poorly suited to septic tank absorption fields because of a poor filtering capacity. The wetness of the Pearl and Leola soils is an additional limitation.

7. Poy-Zittau-Poygan Association

Nearly level and gently sloping, somewhat poorly drained and poorly drained, clayey and silty soils; in glacial lake basins and on moraines

This association is in depressions and drainageways in glacial lake basins and on moraines. Slopes range from 0 to 3 percent.

The association makes up about 4 percent of the county. It is about 35 percent Poy soils, 20 percent Zittau soils, 15 percent Poygan soils, and 30 percent soils of minor extent.

Poy soils are poorly drained. They are slowly permeable in the subsoil and rapidly permeable in the substratum. They are nearly level. Available water capacity is low. Typically, the surface layer is black clay about 12 inches thick. The subsoil is mottled, firm clay about 17 inches thick. It is gray and grayish brown in the upper part and reddish brown in the lower part. The substratum to a depth of about 60 inches is pale brown and light brownish gray, calcareous sand.

Zittau soils are somewhat poorly drained. They are slowly permeable in the clayey subsoil and upper part of the substratum and rapidly permeable in the sandy lower part. They are nearly level and gently sloping. Available water capacity is low. Typically, the surface layer is dark brown clay about 9 inches thick. The subsoil is reddish brown, mottled, firm clay about 7 inches thick. The upper 7 inches of the substratum is reddish brown, mottled, calcareous clay. The lower part to a depth of about 60 inches is brown, mottled loamy sand and light brown, mottled sand. In places the lower part of the substratum is silt loam.

Poygan soils are poorly drained. They are slowly permeable. They are nearly level. Available water capacity is moderate. Typically, the surface layer is black silty clay loam about 11 inches thick. The subsoil is about 21 inches thick. It is mottled and firm. It is gray silty clay in the upper part, gray clay in the next part, and grayish brown clay in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled, calcareous clay.

Minor in this association are Keowns, Manawa, Nebago, and Willette soils. The poorly drained Keowns soils are in depressions. They are intermingled with areas of the Poy and Poygan soils. The somewhat poorly drained Manawa and Nebago soils are in drainageways. They are intermingled with areas of the Zittau soils. The very poorly drained Willette soils are in depressions slightly below the Poy and Poygan soils.

Most of the acreage in this association is drained and used as cropland. Some areas are used as pasture or woodland. The major management concerns are wetness and the low or moderate available water capacity.

The major soils in this association are suited to trees. Wetness during the planting season often limits reforestation to hand planting or natural regeneration.

The Poy and Poygan soils in this association are generally not suited to septic tank absorption fields because of ponding and slow permeability. The Zittau soils are poorly suited to septic tank absorption fields because of wetness and slow permeability.

8. Morocco-Kingsville-Keowns Association

Nearly level and gently sloping, somewhat poorly drained and poorly drained, sandy and silty soils; in glacial lake basins

This association is in drainageways and depressions in glacial lake basins. Slopes range from 0 to 3 percent.

The association makes up about 2 percent of the county. It is about 30 percent Morocco soils, 20 percent Kingsville soils, 15 percent Keowns soils, and 35 percent soils of minor extent.

Morocco soils are somewhat poorly drained. They are rapidly permeable. They are nearly level and gently sloping. Available water capacity is low. Typically, the surface layer is very dark gray fine sand about 8 inches thick. The subsoil is yellowish brown, very friable fine sand about 17 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is yellowish brown and pale brown, mottled fine sand.

Kingsville soils are poorly drained. They are rapidly permeable. They are nearly level. Available water capacity is low. Typically, the surface layer is black loamy sand about 7 inches thick. The next layer is very dark gray and pale brown, very friable sand about 8 inches thick. The substratum to a depth of about 60 inches is grayish brown and pale brown sand.

Keowns soils are poorly drained. They are moderately permeable. They are nearly level. Available water capacity is high. Typically, the surface layer is black silt loam about 13 inches thick. It is mottled in the lower part. The subsoil is about 16 inches thick. It is grayish brown and mottled. It is friable silt loam in the upper part and very friable very fine sandy loam in the lower part. The substratum to a depth of about 60

inches is light brownish gray, grayish brown, and light gray, mottled, calcareous, stratified silt loam, very fine sandy loam, and sandy loam.

Minor in this association are the Adrian soils, the Plainfield soils that have a wet substratum, and the Yahara soils. The very poorly drained Adrian soils are in depressions below the Kingsville and Keowns soils. The moderately well drained Plainfield soils are on flats. They are slightly higher on the landscape than the Morocco soils. The somewhat poorly drained Yahara soils are in drainageways. They are intermingled with areas of the Morocco soils.

Most of the acreage in this association is used as cropland; however, some areas are used as pasture or woodland. The main management concerns are the wetness, low available water capacity, and hazard of soil blowing in areas of the Morocco and Kingsville soils and the wetness of the Keowns soils.

Morocco and Keowns soils are suited to trees, but Kingsville soils are poorly suited to this use. Wetness is a limitation in areas of the Kingsville and Keowns soils. During the planting season, it often limits reforestation to hand planting or natural regeneration. Seedling mortality is a limitation on all the major soils in this association. Planting vigorous nursery stock helps to overcome this limitation.

Morocco soils are poorly suited to septic tank absorption fields because of wetness and a poor filtering capacity. Kingsville and Keowns soils are generally not suited to septic tank absorption fields because of ponding and wetness.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Hortonville, fine sandy loam, 2 to 6 percent slopes, is a phase of the Hortonville series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Boyer-Mecosta complex, 12 to 20 percent slopes, is an example.

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

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

Soil scientists were denied access to a few tracts in the county. These areas were mapped by using knowledge of the soils in the surrounding area and by aerial photo interpretation. Delineations portraying soil boundaries in these areas are less accurately drawn than in areas where soil scientists had access to the land and could examine the soils. These areas are identified on the map sheets by a dashed-line boundary and the notation "Area of Reduced Reliability."

The names of some of the soils do not agree with those of soils in surrounding counties because of changes in concepts of series and mapping criteria, the combination of components of minor extent, and differences in the proportions of soils within each county.

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

Soil Descriptions

Ad—Adrian muck, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in depressions on outwash plains and in glacial lake basins. It is

subject to ponding. Most areas are elongated or irregular in shape and range from 3 to 200 acres in size.

Typically, the organic layer is black muck about 32 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and dark gray sand. In some places the substratum has thin strata of sandy loam. In other places the muck layer is more than 51 inches thick.

Included with this soil in mapping are small areas of Kingsville soils. The poorly drained Kingsville soils are in the slightly higher landscape positions. They are sandy throughout. Included soils make up 2 to 10 percent of mapped areas.

Permeability of this Adrian soil is moderately slow to moderately rapid in the organic layer and is rapid in the substratum. Available water capacity is very high. The organic matter content is very high in the muck layer. This soil has a seasonal high water table.

Most areas support native wetland vegetation. The main plants are water-tolerant trees, marsh grasses, cattails, sedges, reeds, redosier dogwood, and alder. A few areas are drained and used for specialty crops, such as carrots or celery.

This soil is generally unsuited to use as cropland unless drained. Many areas do not have adequate drainage outlets. Ponding and a short growing season limit crop yields and restrict the kinds of crops that can be grown in undrained areas. Wetness and the soft muck limit the use of farm equipment. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by wetness. Soil blowing and subsidence are hazards in drained areas.

This soil is generally not suited to pasture. Organic soils are easily cut by the hooves of cattle; therefore, grazing is restricted to dry periods.

This soil is suited to trees. Wetness during the planting season generally limits reforestation to natural regeneration. The trees generally can be harvested only when the soil is frozen. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields or for dwellings and local roads and streets. The main limitations are ponding, low stability, and the hazard of frost damage. Overcoming these limitations is difficult. A better site should be considered for these uses.

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

Be—Belleville loamy sand, 0 to 2 percent slopes. This nearly level, poorly drained soil is in depressions in glacial lake basins. It is subject to ponding. Most areas are irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is black loamy sand about 10 inches thick. The subsoil is grayish brown, very friable sand about 16 inches thick. The upper part of the substratum is brown sand. The lower part to a depth of about 60 inches is reddish brown, calcareous silty clay loam. In some places the surface layer is muck or mucky loamy sand. In other places depth to the silty lower part of the substratum is more than 40 inches.

Included with this soil in mapping are small areas of Nebago and Poygan soils. Nebago soils are somewhat poorly drained and are in the higher positions on the landscape. Poygan soils are poorly drained. They are in positions on the landscape similar to those of the Belleville soil. They have a clayey subsoil. Also included are small areas that have a silt loam substratum. The included soils make up 5 to 15 percent of mapped areas.

Permeability of the Belleville soil is rapid in the upper part and is moderately slow in the lower part. Available water capacity is low. The organic matter content is moderately low in the surface layer. This layer is very friable, but wetness restricts the time of tillage. The shrink-swell potential is moderate in the substratum. This soil has a seasonal high water table.

Most areas support native wetland vegetation. The main plants are water-tolerant trees, sedges, marsh grasses, and brush. A few areas are used as cropland, pasture, or woodland.

If drained, this soil is suited to corn. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness and the low available water capacity. Open ditches and tile drains are needed. Installing tile in the silty substratum helps to keep sand from entering the tile lines. In places adequate drainage outlets are not available. In some areas the growing season is short because cold air flows into the depressions. In these areas corn can be cut for silage or an early maturing variety of corn can be grown. Alfalfa is subject to the winterkill caused by frost heaving and ice sheeting. Crop yields are limited in most years by the low available water capacity. In drained areas soil blowing is a severe hazard. It can be controlled by chisel plowing or other kinds of conservation tillage that leave

all or part of the crop residue on the surface. Cover crops, field windbreaks, or vegetative row barriers will also reduce soil blowing. Returning crop residue to the soil or regularly adding manure increases fertility and reduces soil loss.

Unless drained, this soil is poorly suited to pasture. Grazing when the soil is wet damages the pasture plants. In most years yields are limited by the low available water capacity. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is poorly suited to trees. Growth is slow, and the trees are poorly formed. Wetness during the planting season limits reforestation to hand planting or natural regeneration. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields or dwellings. The main limitations are ponding and moderately slow permeability. Overcoming these limitations is difficult. A better site should be considered for these uses.

This soil is poorly suited to local roads and streets. The main limitations are the ponding and frost action. Fill material can be added to raise the roadway above the level of ponding. Culverts help to prevent road damage by equalizing the water level on each side of the road.

The land capability classification is Vlw in undrained areas. The woodland ordination symbol is 1W.

Bt—Billett sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on flats on outwash plains. Most areas are irregularly shaped and range from 10 to 400 acres in size.

Typically, the surface layer is black sandy loam about 8 inches thick. The subsoil is about 23 inches thick. It is dark brown, friable sandy loam in the upper part; brown, friable sandy loam in the next part; and brown, very friable gravelly loamy sand in the lower part. The substratum to a depth of about 60 inches is light yellowish brown very gravelly sand. In places the surface layer is lighter in color.

Included with this soil in mapping are small areas of the somewhat excessively drained Richford soils. These soils are in positions on the landscape similar to those of the Billett soil. They have have a subsoil that has more sand than that of the Billett soil. Also, they have a lighter colored surface layer. Also included are small areas where the depth to the substratum is less than 30 inches. The included soils make up 5 to 15 percent of mapped areas.

Permeability of the Billett soil is moderately rapid in the upper part and is rapid in the lower part. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is moderately low in the surface layer. This layer is friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as cropland. This soil is suited to corn and small grain and to grasses and legumes for hay. In most years crop yields are limited by the low available water capacity. If the soil is cultivated, soil blowing is a hazard. It can be controlled by chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, field windbreaks, or vegetative row barriers also reduce the susceptibility to soil blowing. Returning crop residue to the soil or regularly adding manure helps to maintain fertility and reduces soil loss.

Many areas of this soil are used for irrigated corn, snap beans, peas, or potatoes. Because of the loamy surface layer and subsoil, applications of moderately high amounts of water at one time do not result in leaching of plant nutrients below the root zone of most plants.

This soil is suited to pasture. In most years, however, yields are low because of the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is plant competition, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the rapid permeability in the substratum. The soil is suitable as a site for dwellings. It is moderately suited to local roads and streets. Frost action is a hazard, but it can be

prevented by covering or replacing the upper part of the soil with coarse textured base material, such as sand and gravel.

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

ByB—Boyer loamy sand, 2 to 6 percent slopes. This gently sloping, well drained soil is on ridgetops and knolls on outwash plains and moraines. Most areas are irregularly shaped and range from 5 to 150 acres in size.

Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsoil is about 14 inches thick. It is brown, very friable loamy sand in the upper part; brown, friable sandy loam in the next part; and strong brown, very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is light brownish gray, calcareous sand. In places the surface layer is sandy loam or is darker.

Included with this soil in mapping are small areas of the excessively drained Plainfield soils and the somewhat excessively drained Richford soils. These included soils are in positions on the landscape similar to those of the Boyer soil. Plainfield soils are sandy throughout. Richford soils have a subsoil that has more sand and generally less clay than that of the Boyer soil. The included soils make up 5 to 15 percent of mapped areas.

Permeability is moderately rapid in the subsoil of the Boyer soil and is very rapid in the substratum. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low or moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as cropland. Some are used as pasture or woodland.

This soil is suited to corn and small grain and to grasses and legumes for hay. In most years crop yields are limited by the low available water capacity. If the soil is cultivated, soil blowing and water erosion are hazards. Water erosion can be controlled by chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, field windbreaks, or vegetative row barriers reduce the susceptibility to soil blowing. Returning crop residue to the soil or regularly adding manure increases fertility and reduces soil loss.

Some areas of this soil are used for irrigated corn, snap beans, peas, potatoes, or cucumbers. Because of the sandy loam layer in the subsoil, applications of moderately high amounts of water at one time do not result in leaching of nutrients below the root zone of most plants. Other concerns in managing irrigated areas are soil blowing; the even distribution of water, fertilizer, and herbicides through the irrigation system; erosion in wheel tracks; and loss of organic matter.

This soil is suited to pasture. In most years, however, yields are low because of the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is plant competition, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the very rapid permeability in the substratum. The soil is suitable as a site for dwellings and local roads and streets.

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

ByC—Boyer loamy sand, 6 to 12 percent slopes. This sloping, well drained soil is on the sides of ridges and knolls on outwash plains and moraines. Most areas are elongated or irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark brown loamy sand about 7 inches thick. The subsoil is about 14 inches thick. It is brown, very friable loamy sand in the upper part; brown, friable sandy loam in the next part; and strong brown, very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is light brownish gray, calcareous sand. In places the surface layer is sandy loam or is eroded.

Included with this soil in mapping are small areas of the excessively drained Plainfield soils and the somewhat excessively drained Richford soils. These included soils are in positions on the landscape similar to those of the Boyer soil. Plainfield soils are sandy throughout. Richford soils have a subsoil that has more sand and generally less clay than that of the Boyer soil. The included soils make up 5 to 15 percent of mapped areas.

Permeability is moderately rapid in the subsoil of the

Boyer soil and is very rapid in the substratum. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low or moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as cropland. Some are used as pasture or woodland.

This soil is suited to corn and small grain and to grasses and legumes for hay. If the soil is cultivated, soil blowing and water erosion are hazards. They can be controlled by chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, field windbreaks, or vegetative row barriers reduce the susceptibility to soil blowing. Returning crop residue to the soil or regularly adding manure increases fertility and reduces soil loss. In most years crop yields are limited by the low available water capacity.

This soil is suited to pasture. In most years, however, yields are low because of the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is plant competition, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the very rapid permeability in the substratum. The soil is only moderately suited to dwellings and local roads and streets because of the slope. The slope can be modified by cutting and filling. Also, the dwellings can be designed so that they conform to the natural slope of the land.

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

BzD—Boyer-Mecosta complex, 12 to 20 percent slopes. These moderately steep soils are on the side slopes of ridges and hills on moraines. The well drained Boyer soil is on the lower part of the side slopes. The somewhat excessively drained Mecosta soil is on the upper, steeper part of the side slopes. Most areas are irregularly shaped and range from 5 to 100 acres in size. They are about 60 percent Boyer soil and 30 percent Mecosta soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Boyer soil is dark grayish brown loamy sand about 6 inches thick. The subsoil is about 15 inches thick. It is brown, very friable loamy sand in the upper part; brown, friable sandy loam in the next part; and strong brown, very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is light brownish gray, calcareous sand.

Typically, the surface layer of the Mecosta soil is very dark gray gravelly loamy sand about 8 inches thick. The subsoil is brown, very friable gravelly loamy sand about 7 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous very gravelly sand. In places the slope is more than 20 percent.

Included with these soils in mapping are small areas of the excessively drained Coloma and Plainfield soils and the somewhat excessively drained Okee soils. These included soils are in positions on the landscape similar to those of the major soils in the complex. Coloma and Plainfield soils have a subsoil that has more sand than that of the Boyer and Mecosta soils. The solum of the Okee soils is thicker than that of the major soils. Also included are some small areas where the surface layer contains many pebbles, cobbles, and stones. The included soils make up 5 to 15 percent of mapped areas.

Permeability is moderately rapid in the subsoil of the Boyer soil and is very rapid in the substratum. It is rapid in the Mecosta soil. Available water capacity is low in the Boyer soil and very low in the Mecosta soil. It limits the response of plants to additions of plant nutrients. The organic matter content is low or moderately low in the surface layer of the Boyer soil and low in that of the Mecosta soil. The surface layer in both soils is very friable.

Most areas are used as woodland. Some are used for pasture. These soils are generally not used as cropland because of slope and large amounts of gravel, cobbles, and stones in the surface layer of the Mecosta soil.

These soils are poorly suited to pasture. In most years yields are limited by the very low available water capacity. Pasture renovation is difficult because of slope and stones. Overgrazing damages the plant cover and results in water erosion.

These soils are suited to trees. Soil-related problems in woodland management are steepness of slope and

seedling mortality. Planting on the contour helps to control erosion. Skid roads should be properly located so that they do not increase the susceptibility to water erosion. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

These soils are generally not suitable as sites for septic tank absorption fields because of the slope and a poor filtering capacity. Because of the slope, the soils are poorly suited to use as sites for dwellings and local roads and streets. Cutting and filling can modify the slope. Dwellings can be designed so that they conform to the natural slope of the land.

The land capability classification is VIIs. The woodland ordination symbol is 4R for the Boyer soil and 6R for the Mecosta soil.

CoB—Coloma loamy sand, 2 to 6 percent slopes. This gently sloping, excessively drained soil is on ridgetops and knolls on moraines. Most areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is very dark brown loamy sand about 4 inches thick. The subsurface layer is dark brown and strong brown sand about 35 inches thick. The lower layer to a depth of more than 60 inches is light brown, loose sand that has thin strata of brown, friable loamy sand. In some places the surface layer is sand. In other places the lower layer either does not have strata of loamy sand or has strata of sandy loam.

Included with this soil in mapping are small areas of the somewhat excessively drained Richford soils. These soils are in positions on the landscape similar to those of the Coloma soil. They have a subsoil that contains more clay than that of the Coloma soil. Also included are small areas where scattered stones are on the surface. The included soils make up 5 to 15 percent of mapped areas.

Permeability is rapid in the Coloma soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be tilled throughout a wide range of moisture content.

Many areas previously cleared for use as cropland have been planted to pines or are idle. Some are used as cropland or pasture.

This soil is poorly suited to corn and small grain and to grasses and legumes for hay. In most years yields are limited by the low available water capacity. If the soil is cultivated, soil blowing and water erosion are hazards. Chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, contour plowing, and grassed waterways help to prevent excessive soil loss. Field windbreaks, cover crops, and vegetative row barriers reduce the susceptibility to soil blowing. Cover crops, green manure crops, crop residue management, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and reduce soil loss.

Some areas of this soil are used for irrigated corn, snap beans, peas, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, the rapid permeability, and the leaching of plant nutrients below the root zone of most crops. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum. Other management concerns in irrigated areas are soil blowing; the even distribution of water, fertilizer, and herbicides through the irrigation system; water erosion in the wheel tracks; and loss of organic matter.

This soil is poorly suited to pasture. In most years yields are low because of the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is poorly suited to trees. Growth is slow, and the trees are poorly formed. Although the production of merchantable wood is marginal, the trees are effective in controlling soil blowing and erosion. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the rapid permeability. The soil is suitable as a site for dwellings and local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 2S.

CoC—Coloma loamy sand, 6 to 12 percent slopes. This sloping, excessively drained soil is on the sides of ridges and knolls on moraines. Most areas are

irregularly shaped and range from 5 to 200 acres in size.

Typically, the surface layer is dark yellowish brown loamy sand about 4 inches thick. The subsurface layer is yellowish brown sand about 35 inches thick. The lower layer to a depth of more than 60 inches is yellowish brown, loose sand that has thin strata of brown, friable loamy sand. In some places the surface layer is sand. In other places the lower layer either does not have strata of loamy sand or has strata of sandy loam. In some areas the slope is more than 12 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Richford soils. These soils are in positions on the landscape similar to those of the Coloma soil. They have a subsoil that contains more clay than that of the Coloma soil. Also included are small areas where scattered stones are on the surface and where the slope is more than 12 percent. The included soils make up 5 to 10 percent of mapped areas.

Permeability is rapid in the Coloma soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be tilled throughout a wide range of moisture content.

Many areas previously cleared for use as cropland have been planted to pines or are idle. Some are used as pasture or woodland.

This soil is generally not suited to corn or other row crops because of the high susceptibility to soil blowing and water erosion.

This soil is poorly suited to pasture. In most years yields are low because of the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is poorly suited to trees. Growth is slow, and the trees are poorly formed. Although the production of merchantable wood is marginal, the trees are effective in controlling soil blowing and water erosion. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the rapid permeability. The soil is only moderately suitable as a site for dwellings and local roads and streets because of the slope. The slope can be modified by cutting and filling. Also, dwellings can be designed so that they conform to the natural slope of the land.

The land capability classification is VIs. The woodland ordination symbol is 2S.

CoD—Coloma loamy sand, 12 to 30 percent slopes. This moderately steep and steep, excessively drained soil is on the sides of ridges and hills on moraines. Most areas are elongated or irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is very dark brown loamy sand about 4 inches thick. The subsurface layer is yellowish brown sand about 38 inches thick. The lower layer to a depth of more than 60 inches is yellowish brown, loose sand that has thin strata of brown, friable loamy sand. In places the surface layer is sand. In some small areas the lower layer either does not have strata of loamy sand or has strata of sandy loam.

Included with this soil in mapping are small areas of the somewhat excessively drained Richford soils. These soils are in positions on the landscape similar to those of the Coloma soil. They have a subsoil that contains more clay than that of the Coloma soil. Also included are small areas where scattered stones are on the surface. The included soils make up 5 to 10 percent of mapped areas.

Permeability is rapid in the Coloma soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as woodland. This soil is generally not suited to use as cropland or pasture because of soil blowing, water erosion, and the low available water capacity. Also, machinery operation is very difficult because of the slope.

This soil is poorly suited to trees. Growth is slow, and the trees are poorly formed. Although production of merchantable wood is marginal, the trees are effective in controlling soil blowing and water erosion. The main soil-related problems in woodland management are steepness of slope and seedling mortality. Skid roads should be properly located so that they do not increase the susceptibility to erosion. Planting vigorous nursery

stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields because of the slope and a poor filtering capacity. Because of the slope, the soil is poorly suited to dwellings and local roads and streets. Where it is less than about 20 percent, the slope can be modified by cutting and filling. Dwellings can be designed so that they conform to the natural slope of the land.

The land capability classification is VIIs. The woodland ordination symbol is 2R.

FkA—Fisk loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways in glacial lake basins. Most areas are irregular or elongated in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsoil is about 33 inches thick. It is very friable. It is yellowish brown sand in the upper part; brown, mottled fine sandy loam in the next part; and pinkish gray, mottled silt loam in the lower part. The substratum to a depth of about 60 inches is pinkish gray, mottled silt loam. It is calcareous in the lower part. In places the surface layer is darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Morocco and Yahara soils. These included soils are in positions on the landscape similar to those of the Fisk soil. Morocco soils are sandy throughout. The upper part of the subsoil in the Yahara soils has more silt than that of the Fisk soil. Also included are small areas where the sandy deposits are more than 40 inches deep over the loamy deposits. The included soils make up 5 to 15 percent of mapped areas.

Permeability is rapid in the sandy upper part of the Fisk soil and moderate in the loamy and silty deposits. Available water capacity is moderate. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. This soil has a seasonal high water table.

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

If drained, this soil is suited to corn, soybeans, and small grain. Alfalfa is subject to the winterkill caused by frost heaving and ice sheeting. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness and the moderate available water capacity. Open ditches and tile drains are needed. Ditchbanks are subject to sloughing and water erosion. If tile is installed, silt enters the tile lines unless a suitable filter covers the tile. Soil blowing is a hazard during dry periods. It can be controlled by field windbreaks, cover crops, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, a cropping system that includes grasses, crop residue management, and regular additions of manure increase fertility and reduce soil loss.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Overgrazing damages the vegetative cover and increases the extent of undesirable species. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is plant competition, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields and dwellings because of wetness. On sites for absorption fields, this limitation can be overcome by constructing a mound of suitable filtering material. On sites for dwellings, it can be overcome by adding fill material, which raises the site above the level of wetness. On sites for dwellings with basements, installing tile drains around the foundation can reduce the wetness. A dependable outlet, such as a gravity outlet, is needed.

This soil is poorly suited to local roads and streets because of frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand and gravel, and draining the roadbed help to prevent the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 8A.

HnB—Hortonville fine sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on ridgetops and knolls on moraines. Most areas are irregularly shaped and range from 5 to 150 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The next 5 inches is reddish

brown clay loam and brown loam. The subsoil is about 22 inches thick. It is reddish brown and firm. It is clay loam in the upper part and loam in the lower part. The substratum to a depth of about 60 inches is reddish brown, calcareous loam. In some places the surface layer is loamy sand or is eroded. In other places the subsoil and substratum have more clay and less sand.

Included with this soil in mapping are small areas of the Plainfield soils that have a loamy substratum and small areas of Symco soils. Plainfield soils are excessively drained and are in positions on the landscape similar to those of the Hortonville soil. They have a sandy subsoil. Symco soils are somewhat poorly drained and are in the lower positions on the landscape. The included soils make up 5 to 15 percent of mapped areas.

Permeability in the Hortonville soil is moderately slow in the subsoil and moderately slow or slow in the substratum. Available water capacity is high. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range of moisture content. The shrink-swell potential is moderate.

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

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Plants respond well to additions of plant nutrients. If the soil is cultivated, water erosion is a slight or moderate hazard. It can be controlled by chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, contour farming, contour stripcropping, and grassed waterways (fig. 4). In many areas terracing can reduce the length of slopes. Cover crops, green manure crops, crop residue management, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and reduce soil loss.

This soil is suited to pasture. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The main soil-related management problems are plant competition following harvest and the hazard of windthrow caused by the restricted rooting depth. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of the moderately slow permeability. This limitation can be overcome by constructing a mound of suitable filtering material.

This soil is only moderately suited to dwellings because of the moderate shrink-swell potential. The structural damage caused by shrinking and swelling can be prevented by adding coarse textured fill material, such as sand and gravel, under the foundation. On sites for dwellings with basements, the damage can be prevented by backfilling around the foundation with this material.

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

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

HrC2—Hortonville loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on the sides of ridges and knolls on moraines. Most areas are irregularly shaped and range from 5 to 100 acres in size.

In most cultivated areas on the crest of the ridges and knolls and on the upper side slopes, the original surface layer has been lost through water erosion. Typically, the surface layer is brown loam about 6 inches thick. The subsoil is about 20 inches thick. It is reddish brown and firm. It is clay loam in the upper part and loam in the lower part. The substratum to a depth of about 60 inches is brown, calcareous loam. In some places near the base of slopes and in swales, the surface layer is very dark grayish brown fine sandy loam 10 to 20 inches thick. In other places this layer is silt loam. In some areas the soil is not eroded. In other areas the slope is more than 12 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Okee soils and excessively drained Plainfield soils. These included soils are in positions on the landscape similar to those of the Hortonville soil. Okee soils have a subsoil and substratum that have less clay and more sand than those of the Hortonville soil. Plainfield soils are sandy throughout. Also included are small areas where all of the surface layer has been lost through erosion. The included soils make up 5 to 15 percent of mapped areas.

Permeability in the Hortonville soil is moderately slow

Figure 4.—Contour stripcropping in an area of Hortonville fine sandy loam, 2 to 6 percent slopes.

in the subsoil and is moderately slow or slow in the substratum. Available water capacity is high. The organic matter content is moderately low in the surface layer. This layer is friable, but it can be tilled only within a narrow range of moisture content. Because some of the subsoil has been mixed into the plow layer, clods form if the soil is tilled when it is wet. The shrink-swell potential is moderate.

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

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Plants respond well to additions of plant nutrients. If the soil is cultivated, water erosion is a moderate or severe hazard. Following heavy rains, the soil is subject to crusting and puddling, which result in poor emergence of small-seeded crops. Chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, contour plowing, and grassed waterways help to control water erosion. In many areas terracing can reduce the length of slopes. Cover crops, green manure crops, crop residue management, a

cropping system that includes grasses and legumes, and regular additions of manure increase fertility, help to prevent excessive crusting and puddling, and reduce soil loss.

This soil is suited to pasture. Overgrazing depletes the plant cover, increases the extent of undesirable species, and causes water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The main soil-related management problems are the hazard of windthrow caused by the restricted rooting depth and competing vegetation, which interferes with natural regeneration following harvest. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of the moderately slow or slow permeability. This limitation can be overcome by constructing a mound of suitable filtering material.

This soil is only moderately suited to dwellings because of the moderate shrink-swell potential and the slope. The structural damage caused by shrinking and swelling can be prevented by adding coarse textured fill material, such as sand and gravel, under the foundation. On sites for dwellings with basements, the damage can be prevented by backfilling around the foundation with this material. The slope can be modified by cutting and filling, or dwellings can be designed so that they conform to the natural slope of the land.

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

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

Hu—Houghton muck, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in depressions on outwash plains and moraines. It is subject to ponding. Most areas are irregularly shaped and range from 5 to 2,000 acres in size.

Typically, the organic layers are black, very dark gray, or very dark brown muck more than 60 inches thick. In some places thin layers of brown wood fragments or peat are in the muck. In other places marl or mineral soil material is within a depth of 51 inches.

Included with this soil in mapping are small areas that are covered by water most of the year. Also included are small areas where as much as 24 inches of mineral soil material from the eroding uplands has accumulated on the organic material. The included soils make up 2 to 10 percent of mapped areas.

Permeability is moderately slow to moderately rapid in the Houghton soil. Available water capacity is very high. The organic matter content also is very high. This soil has a seasonal high water table.

Most areas support native wetland vegetation. The main plants are water-tolerant trees, marsh grasses, cattails, sedges, reeds, redosier dogwood, and alder. A few areas are drained and used for specialty crops, such as carrots or celery.

This soil is generally unsuited to use as cropland unless drained. Many areas do not have adequate drainage outlets. Ponding and a short growing season limit crop yields and restrict the kinds of crops that can be grown in undrained areas. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness. Wetness and soft muck limit the use of farm equipment. Soil blowing and subsidence are hazards in drained areas.

This soil is generally not suited to pasture. Organic soils are easily cut by hooves of cattle; therefore, grazing is restricted to dry periods.

This soil is suited to trees. Wetness during the planting season generally limits reforestation to natural regeneration. The trees generally can be harvested only when the soil is frozen. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields or for dwellings and local roads and streets because of ponding, low stability, and the hazard of frost damage. Overcoming these limitations is difficult. A better site should be considered for these uses.

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

Hw—Houghton muck, ponded, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in depressions on outwash plains and moraines. It is covered with as much as 3 feet of water throughout the year. Most areas are irregular or circular in shape and

range from 5 to 40 acres in size.

Typically, the organic layers are black and very dark brown muck that is more than 60 inches thick. In some places thin layers of brown woody fragments or peat are in the muck. In other places mineral soil material is within a depth of 51 inches.

Included with this soil in mapping are small areas that are covered with more than 3 feet of water. These inclusions make up 2 to 10 percent of mapped areas.

Permeability is moderately slow to moderately rapid in the Houghton soil. Available water capacity is very high. The organic matter content also is very high. This soil has a seasonal high water table.

This soil is generally not suited to cropland or any type of development. Artificial drainage is generally not feasible because of a lack of suitable outlets. Unless this soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to the addition of plant nutrients is limited by the wetness.

This soil provides wetland wildlife habitat and is used by ducks, muskrats, and nongame birds. Vegetation consists of cattails and sedges.

The land capability classification is VIIIw. This soil is not assigned a woodland ordination symbol.

Ke—Keowns silt loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in depressions in glacial lake basins. It is subject to ponding. Most areas are irregularly shaped and range from 5 to 50 acres in size.

Typically, the surface layer is black silt loam about 13 inches thick. The subsoil is about 16 inches thick. It is grayish brown and mottled. It is friable silt loam in the upper part and very friable very fine sandy loam in the lower part. The substratum to a depth of about 60 inches is light brownish gray, grayish brown, and light gray, mottled, calcareous, stratified silt loam, very fine sandy loam, and sandy loam. In places the surface layer is very fine sandy loam.

Included with this soil in mapping are small areas of Fisk, Palms, and Yahara soils. The somewhat poorly drained Fisk and Yahara soils are in the higher positions on the landscape. The very poorly drained Palms soils are in the lower positions on the landscape. Also included are small areas that have a sandy subsoil and substratum. Included areas make up 5 to 15 percent of mapped areas.

Permeability is moderate in the Keowns soil. Available water capacity is high. The organic matter content is high in the surface layer. This layer is friable, but wetness restricts the time of tillage. This soil has a seasonal high water table.

Most areas are used as cropland. Some are used as pasture or woodland.

If drained, this soil is suited to corn. The high water table is the main limitation. Unless the soil is drained, the rooting depth of most plants is limited by the high water table. The response of plants to additions of plant nutrients is limited by the wetness. In drained areas this response is good. Alfalfa is subject to the winterkill caused by frost heaving and ice sheeting. Small grain is subject to lodging because of the high organic matter content and wetness of the surface layer. Open ditches and tile drains are needed. In many areas suitable drainage outlets are not available. Ditchbanks are subject to sloughing and water erosion. If tile is installed, silt enters the tile lines unless a suitable filter covers the tile. In some areas the growing season is short because cold air flows into the depressions. In these areas, corn can be cut for silage or an early maturing variety of corn can be grown. Returning crop residue to the soil or regularly adding manure helps to maintain fertility.

Unless drained, this soil is poorly suited to pasture. Grazing when the soil is too moist damages the pasture plants and increases the extent of compaction. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Wetness during the planting season often limits reforestation to hand planting or natural regeneration. Planting vigorous nursery stock reduces the seedling mortality rate. The trees generally can be harvested only when the soil is frozen. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields or dwellings because of the ponding. Overcoming this hazard is difficult. Better sites should be considered for these uses.

This soil is poorly suited to local roads and streets because of the ponding and frost action. These hazards can be overcome by adding coarse textured base material, such as sand and gravel, to raise the roadway above the ponding level. Culverts help to prevent road

damage by equalizing the water level on each side of the road.

The land capability classification is IIIw in drained areas. The woodland ordination symbol is 6W.

KnB—Kewaunee loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on ridgetops and knolls on moraines. Most areas are irregularly shaped and range from 3 to 100 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The subsoil is about 24 inches thick. It is reddish brown and firm. It is silty clay loam in the upper part and clay in the lower part. The substratum to a depth of about 60 inches is reddish brown, calcareous silty clay loam. In some places the surface layer is sandy loam or is eroded. In other places the subsoil is clay loam. In some areas the substratum is loam. In other areas the slope is more than 6 percent.

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

Permeability is moderately slow or slow in the Kewaunee soil. Available water capacity is moderate. It limits the response of plants to additions of plant nutrients. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range of moisture content. The shrink-swell potential is high in the subsoil and moderate in the substratum.

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

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. If the soil is cultivated, water erosion is a slight or moderate hazard. It can be controlled by chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, contour plowing, and grassed waterways. In many areas terracing can reduce the length of slopes. Cover crops, green manure crops, crop residue management, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and reduce soil loss.

This soil is suited to pasture. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Soil-related problems in woodland management are seedling mortality and the hazard of windthrow caused by the restricted rooting depth. Use of wheeled equipment in planting and harvesting may be somewhat limited by the clayey texture of the subsoil. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of the moderately slow or slow permeability. This limitation can be overcome by constructing a mound of suitable filtering material.

This soil is poorly suited to dwellings without basements and is only moderately suited to dwellings with basements because of the shrink-swell potential. On sites for buildings without basements, the structural damage caused by shrinking and swelling can be prevented by adding coarse textured fill material, such as sand and gravel, under the foundation. On sites for dwellings with basements, the damage can be prevented by backfilling around the foundation with this material.

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

The land capability classification is IIe. The woodland ordination symbol is 4D.

Ks—Kingsville loamy sand, 0 to 2 percent slopes. This nearly level, poorly drained soil is in depressions in glacial lake basins and on low beach ridges. It is subject to ponding. Most areas are elongated or irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is black loamy sand about 7 inches thick. The next layer is very dark gray and pale brown, very friable sand about 8 inches thick. The substratum to a depth of about 60 inches is grayish brown and pale brown sand. In places the surface layer is muck.

Included with this soil in mapping are small areas of Adrian and Meehan soils. Adrian soils are very poorly drained and are in the lower positions on the landscape. They have a surface layer of muck more than 16 inches

thick. Meehan soils are somewhat poorly drained and are in the higher positions on the landscape. Also included are small areas that have a layer of sandy loam at a depth of 25 to 45 inches and some small areas where the substratum has strata of loamy sand below a depth of 40 inches. The included soils make up 5 to 15 percent of mapped areas.

Permeability is rapid in the Kingsville soil. Available water capacity is low. The organic matter content is high in the surface layer. This layer is very friable. This soil has a seasonal high water table.

Most areas are used as cropland. Some are used as pasture or woodland.

Without controlled drainage, this soil is poorly suited to corn. Wetness is the main limitation. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness. In drained areas the soil is limited by the low available water capacity. Alfalfa is subject to the winterkill caused by ice sheeting and frost heaving. Small grain is subject to lodging because of the high organic matter content and wetness of the surface layer. Open ditches and tile drains are needed. In some areas adequate drainage outlets are not available. Ditchbanks are subject to sloughing and water erosion. If tile is installed, sand enters the tile lines unless a suitable filter covers the tile. In some areas the growing season is short because cold air flows into the depressions. In these areas corn can be cut for silage or an early maturing variety of corn can be grown. Crop yields are limited in most years by the low available water capacity. In drained areas soil blowing is a severe hazard. It can be controlled by chisel plowing and other kinds of conservation tillage that leave all or part of the crop residue on the surface, field windbreaks, and vegetative row barriers. Returning crop residue to the soil or regularly adding manure increases fertility and reduces soil loss.

Many drained areas are used for irrigated corn, snap beans, peas, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, the rapid permeability, and the leaching of plant nutrients below the root zone of most crops. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum.

Unless drained, this soil is poorly suited to pasture. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Wetness during the planting season limits reforestation to hand planting or natural regeneration. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Planting of vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields or dwellings because of ponding, wetness, and a poor filtering capacity. Overcoming these limitations is difficult. Better sites should be considered for these uses.

Because of the ponding, this soil is poorly suited to local roads and streets. Fill material can raise the roadway above the ponding level. Culverts help to prevent road damage by equalizing the water level on each side of the road.

The land capability classification is IVw in drained areas. The woodland ordination symbol is 3W.

Le—Leola loamy sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is in drainageways on outwash plains. Most areas are irregularly shaped and range from 3 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsoil is about 36 inches thick. It is mottled and very friable. It is yellowish brown loamy sand in the upper part, light brownish gray and strong brown loamy sand and sandy loam in the next part, and light brownish gray loamy sand in the lower part. The substratum to a depth of about 60 inches is light brownish gray and strong brown, mottled sand. In places the upper part of the subsoil has as much as 10 percent cobbles or is sand. In other places the sandy upper part is less than 20 inches thick.

Included with this soil in mapping are small areas of Kingsville, Meehan, and Pearl soils. Kingsville soils are poorly drained and are in the lower positions on the landscape. Meehan soils are somewhat poorly drained and are in positions on the landscape similar to those of the Leola soil. They have a subsoil that has more sand than that of the Leola soil. Pearl soils are moderately well drained and are in the slightly higher positions on the landscape. Also included are small areas where the

substratum has strata of loamy sand or sandy loam below a depth of 40 inches. The included soils make up 5 to 15 percent of mapped areas.

Permeability in the Leola soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity is low. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. This soil has a seasonal high water table.

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

If drained, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Alfalfa is subject to the winterkill caused by frost heaving. Yields are limited in most years by the low available water capacity. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness and the low available water capacity. Deep ditches are needed. Ditchbanks are subject to sloughing and water erosion. If tile is installed, sand enters the tile lines unless a suitable filter covers the tile. Soil blowing is a hazard during dry periods. It can be controlled by field windbreaks, cover crops, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, a cropping system that includes grasses, crop residue management, and regular additions of manure increase fertility and reduce soil loss.

Many drained areas are used for irrigated corn, snap beans, peas, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, rapid infiltration, and the leaching of plant nutrients below the root zone of shallow-rooted plants, such as peas and potatoes. Deeper rooted crops, such as corn, can receive larger and less frequent applications of water. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum.

This soil is suited to use as pasture, but the number of suitable forage plants is limited by the seasonal high water table. Overgrazing depletes the vegetative cover, increases the extent of undesirable species, and results in soil blowing. In most years yields are low because of the low available water capacity. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of wetness and a poor filtering capacity. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of wetness, this soil is only moderately suited to dwellings without basements. This limitation can be overcome by raising the site elevation above the level of wetness. Because of the wetness, the soil is poorly suited to dwellings with basements. The wetness can be overcome by constructing the basement above the level of wetness or by installing tile drains around the foundation. A dependable outlet, such as a gravity outlet, is needed.

This soil is only moderately suited to local roads and streets because of the wetness and frost action. Covering the soil with coarse textured fill material, such as sand and gravel, can raise the roadbed above the level of wetness. Draining the roadbed helps to prevent the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 5A.

MbA—Manawa silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways in glacial lake basins and on moraines. Most areas are irregularly shaped and range from 3 to 80 acres in size.

Typically, the surface layer is black silt loam about 9 inches thick. The subsoil is about 20 inches thick. It is reddish brown, mottled, and firm. It is clay in the upper part and silty clay in the lower part. The substratum to a depth of about 60 inches is reddish brown, calcareous silty clay loam. In some places the surface layer is loam or silty clay loam or is lighter in color. In other places the subsoil and substratum have more sand and less clay.

Included with this soil in mapping are small areas of Kewaunee and Poygan soils. Kewaunee soils are well drained and are in the higher positions on the landscape. Poygan soils are poorly drained and are in the lower positions on the landscape. Also included are small areas where the surface layer is as much as 20 inches of sand or loamy sand. The included soils make up 5 to 15 percent of mapped areas.

Permeability is slow in the Manawa soil. Available water capacity is moderate. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled throughout a wide range of moisture

content. The shrink-swell potential is moderate in the subsoil and substratum. This soil has a seasonal high water table.

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

If drained, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Alfalfa is subject to the winterkill caused by frost heaving and ice sheeting. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness and the moderate available water capacity. Open ditches and tile drains are needed. Crop residue management, green manure crops, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and maintain good tilth.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Overgrazing or grazing when the soil is wet causes surface compaction, depletes the plant cover, and increases the extent of undesirable species. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Soil-related problems in woodland management are equipment limitations caused by clay in the upper part of the soil, seedling mortality, and windthrow. Use of wheeled equipment in planting and harvesting is somewhat limited by the clayey texture of the subsoil. Planting vigorous nursery stock reduces the seedling mortality rate. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Because of wetness and slow permeability, this soil is poorly suited to septic tank absorption fields. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of the wetness, this soil is poorly suited to dwellings. This limitation can be overcome by adding fill material, which raises the site above the level of wetness. On sites for dwellings with basements, installing tile drains around the foundation can reduce the wetness. A dependable outlet, such as a gravity outlet, is needed.

This soil is poorly suited to local roads and streets because of frost action and low strength. Covering or replacing the upper part of the soil with coarse textured base material, such as sand and gravel, can overcome these limitations.

The land capability classification is IIw. The woodland ordination symbol is 3C.

MoA—Meehan loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways on outwash plains. Most areas are irregularly shaped and range from 5 to 100 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsoil is mottled, very friable sand about 25 inches thick. It is yellowish brown in the upper part and pale brown sand in the lower part. The substratum to a depth of about 60 inches is pale brown sand. In places the subsoil is loamy sand.

Included with this soil in mapping are small areas of Kingsville and Pearl soils and the Plainfield soils that have a wet substratum. Kingsville soils are poorly drained and are in the lower positions on the landscape. Plainfield and Pearl soils are moderately well drained and are in the higher positions on the landscape. The subsoil of the Pearl soils has more clay than that of the Meehan soil. Also included are small areas where the substratum has strata of loamy sand below a depth of 40 inches. The included soils make up 5 to 15 percent of mapped areas.

Permeability is rapid in the Meehan soil. Available water capacity is low. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. This soil has a seasonal high water table.

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

If drained, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Wetness is the main limitation. Deep ditches are needed to overcome this limitation. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness and the low available water capacity. Yields are limited in most years because of the low available water capacity. Alfalfa is subject to the winterkill caused by frost heaving. Ditchbanks are subject to sloughing and water erosion. If tile is installed, sand enters the tile lines unless a suitable filter covers the tile. Soil blowing is a hazard during dry periods. It can be controlled by field windbreaks, cover crops, vegetative row barriers,

and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, a cropping system that includes grasses and legumes, crop residue management, and regular additions of manure increase fertility and reduce soil loss.

Many drained areas of this soil are used for irrigated corn, peas, snap beans, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, rapid permeability, and the leaching of nutrients below the root zone of most crops. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Yields are low during dry periods because of the low available water capacity. Overgrazing depletes the vegetative cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Planting must often be delayed because of low soil strength during the extended thaw period in spring. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of wetness and a poor filtering capacity. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of wetness, this soil is poorly suited to dwellings. This limitation can be overcome by adding fill material, which raises the site above the level of wetness. On sites for dwellings with basements, installing tile drains around the foundation can reduce the wetness. A dependable outlet, such as a gravity outlet, is needed.

This soil is only moderately suited to local roads and streets because of wetness and frost action. These limitations can be overcome by adding coarse textured fill material, such as sand and gravel, to raise the roadbed above the level of wetness and by using open ditches or a drainage system to lower the seasonal high water table.

The land capability classification is IVw. The woodland ordination symbol is 9W.

MrA—Morocco fine sand, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways in glacial lake basins. Most areas are irregularly shaped and range from 3 to 200 acres in size.

Typically, the surface layer is very dark gray fine sand about 8 inches thick. The subsoil is yellowish brown, very friable fine sand about 17 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is yellowish brown and pale brown, mottled fine sand. In places the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Fisk, Kingsville, and Nebago soils. Fisk and Nebago soils are somewhat poorly drained and are in positions on the landscape similar to those of the Morocco soil. Fisk soils have silt loam in the lower part of the subsoil and in the substratum. Nebago soils have clay in the lower part of the subsoil and in the substratum. Kingsville soils are poorly drained and are in the lower positions on the landscape. Also included are small areas where the substratum has strata of silt below a depth of 40 inches. The included soils make up 5 to 15 percent of mapped areas.

Permeability is rapid in the Morocco soil. Available water capacity is low, but this soil receives seepage water from the finer textured surrounding soils during most of the year. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. This soil has a seasonal high water table.

Most areas are undrained and are used for corn. A few are used as pasture or woodland. If drained, this soil is suited to small grain and to grasses and legumes for hay. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. In most years the seasonal high water table does not limit the planting, growing, and harvesting of corn. The response of plants to additions of plant nutrients is limited by the wetness and the low available water capacity. Deep ditches are needed. Ditchbanks are subject to sloughing and water erosion. If tile is installed, fine sand enters the tile lines unless a suitable filter covers the tile. The included Fisk and Nebago soils greatly increase the problems of installing drainage systems. Soil blowing is a hazard during dry periods. It can be controlled by field windbreaks, cover crops, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, a cropping system that includes grasses, crop

residue management, and regular additions of manure increase fertility and reduce soil loss. Use of irrigation helps to overcome the low available water capacity. Irrigation systems are not presently used because of the difficulty in locating suitable wells or aquifer ponds that can supply water at the needed rate.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Yields are low during dry periods because of the low available water capacity. Overgrazing depletes the vegetative cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of wetness and a poor filtering capacity. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of wetness, this soil is poorly suited to dwellings. This limitation can be overcome by adding fill material to raise the site above the level of wetness. On sites for dwellings with basements, installing tile drains around the foundation can reduce the wetness. A dependable outlet, such as a gravity outlet, is needed.

This soil is only moderately suited to local roads and streets because of wetness and frost action. These limitations can be overcome by using coarse textured fill material, such as sand and gravel, to raise the roadbed above the level of wetness and by using open ditches or a drainage system to lower the seasonal high water table.

The land capability classification is IVw. The woodland ordination symbol is 9S.

NeA—Nebago loamy fine sand, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways in glacial lake basins. Most areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 9 inches thick. The subsoil is about 33 inches thick. It is mottled. It is brown, very friable fine sand in the upper part; brown, very friable fine sandy loam in the next part; and reddish brown, firm clay in the lower part. The substratum to a depth of about 60 inches is reddish brown, calcareous clay. In places the surface layer is sand or fine sand.

Included with this soil in mapping are small areas of Kewaunee, Manawa, Poygan, and Tustin soils. Kewaunee and Tustin soils are well drained and are in the higher positions on the landscape. Manawa soils are somewhat poorly drained and are in positions on the landscape similar to those of the Nebago soil. The surface layer and subsoil of the Manawa soils have more clay and less sand than those of the Nebago soil. Poygan soils are poorly drained and are in the lower positions on the landscape. Also included are small areas that have more than 40 inches of sandy material over the clayey deposits and some small areas where free carbonates are within a depth of 40 inches. The included soils make up 5 to 15 percent of mapped areas.

Permeability in the Nebago soil is rapid in the sandy part of the subsoil and moderately slow or slow in the clayey part of the subsoil and in the substratum. Available water capacity is low. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. The shrink-swell potential is high in the clayey part of this soil. The soil has a seasonal high water table.

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

If drained, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Yields are limited in most years because of the low available water capacity. Alfalfa is short-lived because of frost heaving and ice sheeting. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the seasonal high water table and the low available water capacity. Open ditches and tile drains are needed. Soil blowing is a hazard during dry periods. It can be controlled by field windbreaks, cover crops, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, a cropping system that includes grasses and legumes, crop residue management, and regular additions of manure increase fertility and reduce soil loss.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Yields are low during dry periods because

of the low available water capacity. Overgrazing depletes the vegetative cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of wetness, a poor filtering capacity in the sandy upper part of the soil, and slow or moderately slow permeability in the clayey lower part. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of wetness, this soil is poorly suited to dwellings without basements. This limitation can be overcome by adding fill to raise the site above the level of wetness. Because of wetness and the high shrink-swell potential, this soil is poorly suited to dwellings with basements. These limitations can be overcome by adding fill to raise the site above the level of wetness. A tile drain around the foundation and a gravity or other dependable outlet can reduce the wetness. The shrink-swell potential can also be overcome by adding coarse textured fill material, such as sand and gravel, under the foundation and backfilling around the foundation with this material.

This soil is only moderately suited to local roads and streets because of wetness and frost action. These limitations can be overcome by using coarse textured fill material, such as sand and gravel, to raise the roadbed above the level of wetness and by using open ditches or a subsurface drainage system to lower the seasonal high water table.

The land capability classification is IIIw. The woodland ordination symbol is 3S.

OkB—Okee loamy sand, 2 to 6 percent slopes. This gently sloping, somewhat excessively drained soil is on ridgetops and knolls on moraines. Most areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is dark brown loamy sand about 7 inches thick. The subsoil extends to a depth of about 60 inches. It is yellowish brown, very friable sand in the upper layer; brown, friable sandy loam in the next layer; brown, very friable loamy sand in the next layer; and brown, very friable sand in the lower layer. In places the surface layer is sandy loam.

Included with this soil in mapping are small areas of the well drained Hortonville and excessively drained Plainfield soils. These included soils are in positions on the landscape similar to those of the Okee soil. Hortonville soils have a subsoil that has more clay and less sand than that of the Okee soil. Plainfield soils are sandy throughout. Also included are small areas that have many cobbles and stones in the surface layer. The included soils make up 5 to 10 percent of mapped areas.

Permeability is moderate or moderately rapid in the Okee soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Many areas are used as cropland. Some are used as pasture or woodland.

This soil is suited to corn and small grain and to grasses and legumes for hay. In most years yields are limited by the low available water capacity. If the soil is cultivated, soil blowing and water erosion are hazards. Chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, contour plowing, and grassed waterways help to prevent excessive water erosion. Field windbreaks, cover crops, vegetative row barriers, and conservation tillage help to control soil blowing. Cover crops, green manure crops, crop residue management, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and reduce soil loss.

This soil is suited to pasture. In most years, however, yields are low because of the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is poorly suited to hardwoods but is suited to conifers. Growth of hardwoods is slow, and the trees are poorly formed. Although the production of merchantable wood is marginal, the trees are effective in controlling soil blowing and erosion. Plant competition

following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is suited to septic tank absorption fields, dwellings, and local roads and streets.

The land capability classification is IIIs. The woodland ordination symbol is 2A.

OkC—Okee loamy sand, 6 to 12 percent slopes. This sloping, somewhat excessively drained soil is on the sides of ridges and knolls on moraines. Most areas are irregularly shaped and range from 5 to 100 acres in size.

Typically, the surface layer is black loamy sand about 2 inches thick. The subsoil extends to a depth of about 60 inches. In sequence downward, it is dark yellowish brown, very friable loamy sand; yellowish brown, very friable sand; brown, friable sandy loam; brown, very friable loamy sand; and brown, very friable sand. In places the surface layer is sandy loam.

Included with this soil in mapping are small areas of the well drained Hortonville and excessively drained Plainfield soils. These included soils are in positions on the landscape similar to those of the Okee soil. Hortonville soils have a subsoil that has more clay and less sand than that of the Okee soil. Plainfield soils are sandy throughout. Also included are small areas that have many cobbles and stones in the surface layer. The included soils make up 5 to 10 percent of mapped areas.

Permeability is moderate or moderately rapid in the Okee soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

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

This soil is suited to corn and small grain and to grasses and legumes for hay. In most years yields are limited by the low available water capacity. If the soil is cultivated, soil blowing and water erosion are hazards. Chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, contour plowing, and grassed waterways help to prevent excessive soil loss. Field windbreaks, cover crops, vegetative row barriers, and conservation tillage also help to control soil blowing. Cover crops, green manure crops, crop residue management, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and reduce soil loss.

This soil is suited to pasture. In most years, however, yields are low because of the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is poorly suited to hardwoods but is suited to conifers. Growth of hardwoods is slow, and the trees are poorly formed. Although the production of merchantable wood is marginal, the trees are effective in controlling soil blowing and water erosion. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Because of the slope, this soil is only moderately suited to septic tank absorption fields, dwellings, and local roads and streets. This limitation can be overcome by cutting and filling to modify the slope.

The land capability classification is IIIe. The woodland ordination symbol is 2A.

OkD—Okee loamy sand, 12 to 20 percent slopes. This moderately steep, somewhat excessively drained soil is on the sides of ridges and hills on moraines. Most areas are elongated and range from 5 to 40 acres in size.

Typically, the surface layer is very dark brown loamy sand about 2 inches thick. The subsoil extends to a depth of about 60 inches. It is strong brown, very friable sand in the upper part; brown, friable sandy loam in the next part; and brown, very friable loamy sand in the lower part. In some places the surface layer is sandy loam. In other places 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 Plainfield soils. These soils are in positions on the landscape similar to those of the Okee soil. They are sandy throughout. Also included are small areas where many cobbles and stones are on the surface. The included soils make up 5 to 10 percent of mapped areas.

Permeability is moderate or moderately rapid in the Okee soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as woodland. A few are used

for pasture. Some areas that were formerly cropped are now planted to trees or are idle.

This soil is poorly suited to use as cropland. If the soil is cultivated, soil blowing is a hazard, water erosion is a severe hazard, and the use of equipment is severely limited because of the slope.

This soil is suited to pasture. In most years, however, yields are limited by the low available water capacity. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Deep-rooted legumes, such as alfalfa, grow best. Pasture renovation is difficult because of the slope. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is poorly suited to hardwoods but is suited to conifers. Growth of hardwoods is slow, and the trees are poorly formed. Although production of merchantable wood is marginal, the trees are effective in controlling soil blowing and erosion. The main soil-related problem in woodland management is steepness of slope. Skid roads should be properly located so that they do not increase the susceptibility to water erosion. Planting on the contour helps to control erosion. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Because of the slope, this soil is generally not suitable as a site for septic tank absorption fields and is poorly suited to dwellings and local roads and streets. Cutting and filling can modify the slope on sites for dwellings or for local roads and streets. Also, the dwellings can be designed so that they conform to the natural slope of the land.

The land capability classification is IVe. The woodland ordination symbol is 2R.

Pa—Palms muck, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in depressions in glacial lake basins. It is subject to ponding. Most areas are elongated or irregular in shape and range from 10 to 200 acres in size.

Typically, the organic layer is black muck about 26 inches thick. The substratum to a depth of about 60 inches is gray silt loam. In some places the substratum is sand or clay. In other places the muck layer is more than 51 inches thick.

Included with this soil in mapping are small areas of the poorly drained Keowns and Poygan soils. These included soils are in the higher positions on the landscape. They formed in silty and loamy or silty and clayey deposits. They make up 2 to 10 percent of mapped areas.

Permeability in the Palms soil is moderately slow to moderately rapid in the muck layer and is moderate or moderately slow in the substratum. Available water capacity is very high. The organic matter content is very high in the muck layer. This soil has a seasonal high water table.

Most areas support native vegetation. The main plants are water-tolerant trees, marsh grasses, cattails, sedges, reeds, redosier dogwood, and alder. A few areas are drained and used for corn or specialty crops, such as lettuce and carrots.

This soil is poorly suited to use as cropland. Many areas do not have adequate drainage outlets. The hazard of ponding and a short growing season, which is caused by cold air flowing into depressions, limit crop yields and restrict the kinds of crops that can be grown. Wetness and the soft muck limit the use of farm equipment. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness. Soil blowing and subsidence are hazards in drained areas.

This soil is generally not suited to pasture. Organic soils are easily cut by the hooves of cattle; therefore, grazing is restricted to dry periods.

This soil is suited to trees. Wetness during the planting season generally limits reforestation to natural regeneration. The trees generally can be harvested only when the soil is frozen. Harvesting by clear-cutting or area-selection methods reduces windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields or for dwellings and local roads and streets because of the ponding, low stability, and the hazard of frost damage. Overcoming these limitations is difficult. A better site should be considered for these uses.

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

PbA—Pearl loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping, moderately well drained soil is on flats and in slightly depressed areas on outwash plains and stream terraces. Most areas are irregularly shaped and range from 5 to 500 acres in size.

Typically, the surface layer is very dark brown loamy

sand about 8 inches thick. The subsurface layer is brown sand about 28 inches thick. It is mottled in the lower part. The subsoil is about 8 inches thick. It is dark brown, mottled, and very friable. It is sandy loam in the upper part and loamy sand in the lower part. The substratum to a depth of about 60 inches is light brownish gray, mottled sand. In some places the upper part of the subsoil is loamy sand or sand. In other places a stratum in which the content of cobbles is as much as 20 percent is at a depth of about 20 inches. In some areas the soil is well drained.

Included with this soil in mapping are small areas of Leola and Meehan soils. These included soils are somewhat poorly drained and are in the slightly lower positions on the landscape. They make up 2 to 10 percent of mapped areas.

Permeability in the Pearl soil is moderately rapid in the subsoil and is rapid in the substratum. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low or moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. This soil has a seasonal high water table.

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

This soil is suited to corn and small grain and to grasses and legumes for hay. Deep-rooted plants, such as alfalfa, are short-lived because of the seasonal high water table. Yields are limited in most years because of the low available water capacity. If the soil is cultivated, soil blowing is a hazard in dry periods. It can be controlled by field windbreaks, cover crops, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, a cropping system that includes grasses and legumes, crop residue management, and regular additions of manure increase fertility and reduce soil loss.

Many areas are used for irrigated corn, snap beans, peas, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, rapid infiltration, and the leaching of plant nutrients below the root zone of shallow-rooted crops, such as peas and potatoes. Deeper rooted crops, such as corn, can receive larger and less frequent applications of water. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum.

This soil is suited to pasture. In most years, however, yields are limited by the low available water capacity. Deep-rooted legumes, such as alfalfa, are short-lived because of the seasonal high water table. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is plant competition, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

Because of wetness, this soil is poorly suited to septic tank absorption fields. This limitation can be overcome by constructing a mound of suitable filtering material.

This soil is suited to dwellings without basements. Because of wetness, it is only moderately suited to dwellings with basements. The wetness can be corrected by installing tile drains around the foundation. A dependable outlet, such as a gravity outlet, is needed. Raising the site elevation with fill material above the level of wetness increases the depth to the water table. This soil is suited to local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 9A.

Pe—Pits, gravel. These are areas from which sand and gravel have been removed to a depth of at least several feet. Most areas are irregularly shaped and range from 3 to 40 acres in size.

The pits are mostly in or near areas of the Billett, Boyer, or Richford soils. Typically, the material remaining on the bottom and side walls of most pits is sand and gravel, but in some places the material includes sandy and loamy glacial till or clayey deposits.

Included with this unit in mapping is spoil from the excavated pits, which includes soil that was pushed from the pit area before excavation and piles of other discarded material. Also included are stones or boulders that were too large to crush.

Sand and gravel are still excavated in some pits. Other pits, however, have been abandoned and are overgrown with weeds and brush. Some abandoned pits have filled with water. In reclaiming the areas, land shaping and the addition of suitable topsoil generally are required to establish a vegetative cover.

Onsite investigation is needed to determine the

suitability of the pit areas for septic tank absorption fields, for dwellings, and for local roads and streets.

Pits, gravel, has not been assigned a land capability classification or a woodland ordination symbol.

PfA—Plainfield sand, 0 to 2 percent slopes. This nearly level, excessively drained soil is on flats on outwash plains, moraines, and stream terraces. Most areas are irregularly shaped and range from 10 to 200 acres in size.

Typically, the surface layer is dark brown sand about 7 inches thick. The subsoil is sand about 29 inches thick. It is brown and very friable in the upper part, strong brown and very friable in the next part, and brown and loose in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand. In some places it is mottled below a depth of 40 inches. In other places the surface layer is loamy sand or is darker.

Included with this soil in mapping are small areas of Meehan and Richford soils. Meehan soils are somewhat poorly drained and are in the lower positions on the landscape. Richford soils are in positions on the landscape similar to those of the Plainfield soil. They are somewhat excessively drained. The subsoil of the Richford soils has more clay than that of the Plainfield soil. The included soils make up 2 to 10 percent of mapped areas.

Permeability is rapid in the Plainfield soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used for irrigated crops. This soil is poorly suited to unirrigated crops. Yields are limited in most years because of the low available water capacity. If the soil is cultivated, soil blowing is a hazard. It can be controlled by cover crops, field windbreaks, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface.

Irrigated areas are used for corn, soybeans, peas, snap beans, or potatoes (fig. 5). Light, frequent applications of water are necessary because of the low available water capacity, the rapid permeability, and the leaching of plant nutrients below the root zone of most crops. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum.

This soil is poorly suited to pasture. In most years, yields are limited by the low available water capacity. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Deep-rooted legumes, such as alfalfa, grow best. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the rapid permeability. The soil is suitable as a site for dwellings and for local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 8S.

PfB—Plainfield sand, 2 to 6 percent slopes. This gently sloping, excessively drained soil is on ridgetops and knolls on outwash plains, stream terraces, and moraines. Most areas are irregularly shaped and range from 5 to 200 acres in size.

Typically, the surface layer is brown sand about 8 inches thick. The subsoil is dark yellowish brown sand about 15 inches thick. The upper part is very friable, and the lower part is loose. The substratum to a depth of about 60 inches is yellowish brown sand. In some places the surface layer is loamy sand. In other places the substratum has thin strata of loamy sand below a depth of 36 inches.

Included with this soil in mapping are small areas of the somewhat excessively drained Okee and Richford soils. These included soils are in positions on the landscape similar to those of the Plainfield soil. They have a subsoil that has more clay than that of the Plainfield soil. Also included are small areas where all of the surface layer has been removed by soil blowing. The included soils make up 5 to 15 percent of mapped areas.

Permeability is rapid in the Plainfield soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Figure 5.—An irrigated area of Plainfield sand, 0 to 2 percent slopes, used for potatoes.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is poorly suited to corn and small grain and to grasses and legumes for hay. Yields are limited in most years by the low available water capacity. If the soil is cultivated, soil blowing and water erosion are hazards. They can be controlled by field windbreaks, cover crops, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, crop residue management, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and reduce soil loss.

Many areas are used for irrigated corn, soybeans, snap beans, peas, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, the rapid permeability, and the leaching of plant nutrients below the root zone of most crops. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum. Other concerns in managing irrigated areas are soil blowing; the even distribution of water, fertilizer, and herbicides through the irrigation system; water erosion in the wheel tracks; and loss of organic matter.

This soil is poorly suited to pasture. In most years yields are limited by the low available water capacity. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of

grazing help to keep the pasture in good condition. Deep-rooted legumes, such as alfalfa, grow best. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the rapid permeability. The soil is suitable as a site for dwellings and for local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 8S.

PfC—Plainfield sand, 6 to 12 percent slopes. This sloping, excessively drained soil is on the sides of ridges and knolls on outwash plains, stream terraces, and moraines. Most areas are irregularly shaped and range from 5 to 200 acres in size.

Typically, the surface layer is brown sand about 8 inches thick. The subsoil is dark yellowish brown sand about 12 inches thick. The upper part is very friable, and the lower part is loose. The substratum to a depth of about 60 inches is yellowish brown and light yellowish brown sand. In some places the surface layer is loamy sand. In other places the substratum has thin strata of loamy sand below a depth of 36 inches.

Included with this soil in mapping are small areas of the somewhat excessively drained Okee and Richford soils. These included soils are in positions on the landscape similar to those of the Plainfield soil. They have a subsoil that has more clay than that of the Plainfield soil. Also included are small areas where all of the surface layer has been removed by soil blowing. The included soils make up 5 to 15 percent of mapped areas.

Permeability is rapid in the Plainfield soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Many areas previously cleared for use as cropland have been planted to pines or are idle. Some areas are used as pasture or woodland. This soil is generally not suited to corn or other row crops because of a high susceptibility to soil blowing and water erosion.

This soil is poorly suited to grasses and legumes for hay. If the soil is properly managed, a cover of pasture plants can help to control soil blowing and water erosion. Overgrazing depletes the plant cover and results in soil blowing and water erosion. In most years yields are limited by the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the rapid permeability. The soil is only moderately suitable as a site for dwellings and local roads and streets because of the slope. The slope can be modified by cutting and filling. Dwellings can be designed so that they conform to the natural slope of the land.

The land capability classification is VIs. The woodland ordination symbol is 8S.

PfD—Plainfield sand, 12 to 30 percent slopes. This moderately steep and steep, excessively drained soil is on the sides of ridges and hills on outwash plains and moraines. Most areas are irregular or elongated in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark brown sand about 4 inches thick. The subsoil is strong brown sand about 15 inches thick. It is very friable in the upper part and loose in the lower part. The substratum to a depth of about 60 inches is light yellowish brown sand. In some places the surface layer is loamy sand. In other places the substratum has thin strata of loamy sand below a depth of 36 inches. In places the slope is less than 12 percent.

Included with this soil in mapping are small areas of the somewhat excessively drained Okee and Richford soils. These included soils are in positions on the landscape similar to those of the Plainfield soil. They have a subsoil that has more clay than that of the Plainfield soil. Also included are some small areas where all of the surface layer has been removed by soil blowing. The included soils make up 5 to 15 percent of mapped areas.

Permeability is rapid in the Plainfield soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as woodland. The soil is generally not suited to cropland or pasture because of the hazards of soil blowing and water erosion and the low available water capacity. Also, operating machinery is very difficult because of the slope.

This soil is suited to trees. Planting with wheeled equipment is somewhat limited by the sandy surface layer and the slope. Planting trees on the contour helps to control water erosion. Skid roads should be properly located so that they do not increase the susceptibility to water erosion. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Because of the slope and a poor filtering capacity, this soil is generally not suitable as a site for septic tank absorption fields. Because of the slope, it is poorly suited to dwellings and local roads and streets. Where it is less than about 20 percent, the slope can be modified by cutting and filling. Dwellings can be designed so that they conform to the natural slope of the land.

The land capability classification is VIIs. The woodland ordination symbol is 8R.

PlB—Plainfield sand, loamy substratum, 2 to 6 percent slopes. This gently sloping, excessively drained soil is on ridgetops and knolls on moraines. Most areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is dark brown sand about 7 inches thick. The subsoil is strong brown sand about 13 inches thick. It is very friable in the upper part and loose in the lower part. The upper 32 inches of the substratum is strong brown and yellowish brown sand. The lower part to a depth of about 60 inches is reddish brown loam. In some places the lower part of the substratum has strata of silt loam and very fine sandy loam or is sand. In other places the slope is less than 2 percent.

Included with this soil in mapping are small areas of the well drained Hortonville soils. These soils are in positions on the landscape similar to those of the Plainfield soil. The subsoil and upper part of the substratum in the Hortonville soils have more clay and less sand than those of the Plainfield soil. Also included are small areas where the loamy substratum of the Plainfield soil is mottled and some small areas where all of the surface layer has been removed by soil blowing. The included soils make up 5 to 10 percent of mapped areas.

Permeability in the Plainfield soil is rapid in the subsoil and upper part of the substratum and is moderate in the lower part of the substratum. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as cropland. Some are used as pasture or woodland.

This soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay. It is suited to deep-rooted crops, such as alfalfa. Yields are limited in most years by the low available water capacity. If cultivated crops are grown, soil blowing is a hazard. It can be controlled by field windbreaks, cover crops, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, crop residue management, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and reduce soil loss. Irrigation systems can be used to overcome the low available water capacity, but they are not generally installed because of the difficulty in locating suitable wells or aquifer ponds.

This soil is poorly suited to pasture. In most years yields are limited by the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute the ground water because of the rapid

permeability in the subsoil and upper part of the substratum. The soil is suitable as a site for dwellings and for local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 8S.

PmA—Plainfield sand, wet substratum, 0 to 3 percent slopes. This nearly level and gently sloping, moderately well drained soil is on flats and in slightly depressed areas on outwash plains, stream terraces, and moraines. Most areas are irregular or elongated in shape and range from 5 to 80 acres in size.

Typically, the surface layer is dark brown sand about 7 inches thick. The subsoil is strong brown sand about 14 inches thick. It is very friable in the upper part and loose in the lower part. The upper 32 inches of the substratum is brownish yellow sand. The lower part to a depth of about 60 inches is brownish yellow and light gray, mottled sand. In some places the surface layer is loamy sand. In other places the substratum has thin strata of loamy sand or sandy loam below a depth of 40 inches. In some areas the soil does not have mottles in the lower part of the substratum, and in others it has a thin layer of sandy loam in the subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Morocco soils. These soils are in the lower positions on the landscape. Also included are small areas of soils that formed in deposits of fine sand. The subsoil and substratum of these soils have a slightly higher reaction than those of the Plainfield soil. The included soils make up 2 to 10 percent of mapped areas.

Permeability is rapid in the Plainfield soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. This soil has a seasonal high water table.

Most areas are used as cropland. Some are used as pasture or woodland.

Because of the low available water capacity, this soil is poorly suited to corn, soybeans, and small grain and to grasses and legumes for hay. Yields are limited in most years because of the low available water capacity. Deep-rooted plants, such as alfalfa, are short-lived because of a the seasonal high water table. If the soil is cultivated, soil blowing is a hazard. It can be controlled by field windbreaks, cover crops, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, a cropping system that includes grasses and legumes, crop residue management, and regular additions of manure increase fertility.

Many areas are used for irrigated corn, snap beans, peas, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, the rapid permeability, and the leaching of plant nutrients below the root zone of most crops. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum.

This soil is poorly suited to pasture. In most years yields are limited by the low available water capacity. Deep-rooted legumes, such as alfalfa, are short-lived because of the seasonal high water table. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it may pollute ground water because of the rapid permeability and the seasonal high water table. These limitations can be overcome by constructing a mound of suitable filtering material.

This soil is suitable as a site for dwellings without basements. Because of wetness, it is only moderately suited to dwellings with basements. The wetness can be overcome by installing tile drains around the foundation. A dependable outlet, such as a gravity outlet, is needed. Fill material can be used to raise the site elevation above the level of wetness. This soil is suited to local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 8S.

Pt—Poy clay, 0 to 2 percent slopes. This nearly level, poorly drained soil is in depressions in glacial lake basins. It is subject to ponding. Most areas are irregularly shaped and range from 5 to 80 acres in size.

Typically, the surface layer is black clay about 12 inches thick. The subsoil is mottled, firm clay about 17 inches thick. It is gray and grayish brown in the upper part and reddish brown in the lower part. The substratum to a depth of about 60 inches is pale brown

and light brownish gray, calcareous sand. In places the surface layer is muck.

Included with this soil in mapping are small areas of Kingsville, Willette, and Zittau soils. Kingsville soils are poorly drained and are in positions on the landscape similar to those of the Poy soil. They are sandy throughout. Willette soils are very poorly drained and are in the lower positions on the landscape. They formed in 16 to 51 inches of muck. Zittau soils are somewhat poorly drained and are in the higher positions on the landscape. The included soils make up 5 to 15 percent of mapped areas.

Permeability in the Poy soil is slow in the subsoil and rapid in the substratum. Available water capacity is low. The organic matter content is high in the surface layer. This surface layer is firm and clayey. Clods form if the soil is tilled when it is too moist. The shrink-swell potential is high in the subsoil. This soil has a seasonal high water table.

Most areas are used as cropland. Some are used as pasture or woodland.

If drained, this soil is suited to corn. Alfalfa is subject to the winterkill caused by frost heaving and ice sheeting. Small grain is subject to lodging because of the high organic matter content and wetness of the surface layer. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness or, in drained areas, by the low available water capacity. Open ditches and tile drains are needed. In some areas adequate drainage outlets are not available. Ditchbanks are subject to sloughing and water erosion. If tile is installed, sand enters the tile lines unless a suitable filter covers the tile. In some areas the growing season is short because cold air flows into the depressions. In these areas corn can be cut for silage or an early maturing variety can be grown. Returning crop residue to the soil or regularly adding manure helps to maintain fertility, increases the rate of water infiltration, and improves tilth.

Unless drained, this soil is poorly suited to pasture. Grazing when the soil is too moist damages the pasture plants and increases the extent of compaction. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Wetness during the planting season limits reforestation to hand planting or natural regeneration. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields or dwellings because of the ponding, the slow permeability in the subsoil, the rapid permeability in the substratum, and the high shrink-swell potential. Overcoming these limitations is difficult. A better site should be considered for these uses.

This soil is poorly suited to local roads and streets because of the ponding, low strength, and the high shrink-swell potential. These limitations can be overcome by adding coarse textured base material, such as sand and gravel, to raise the roadway above the ponding level. Culverts help to prevent road damage by equalizing the water level on each side of the road.

The land capability classification is IIw in undrained areas. The woodland ordination symbol is 4W.

Py—Poygan silty clay loam, 0 to 2 percent slopes. This nearly level, poorly drained soil is in depressions in glacial lake basins and on moraines. It is subject to ponding. Most areas are elongated or irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is black silty clay loam about 11 inches thick. The subsoil is about 21 inches thick. It is mottled and firm. It is gray silty clay in the upper part, gray clay in the next part, and grayish brown clay in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled, calcareous clay. In some places the surface layer is muck, and in other places the substratum is sand.

Included with this soil in mapping are small areas of Manawa, Willette, and Zittau soils. Manawa and Zittau soils are somewhat poorly drained and are in the higher positions on the landscape. Zittau soils are underlain by sand. Willette soils are very poorly drained and are in the lower positions on the landscape. They formed in 16 to 51 inches of muck. The included soils make up 2 to 10 percent of mapped areas.

Permeability is slow in the Poygan soil. Available water capacity is moderate. The organic matter content is high in the surface layer. This layer is friable, but wetness restricts the time of tillage. Also, the content of clay is high enough for clods to form if the soil is tilled when it is too moist. The shrink-swell potential is high in the subsoil and substratum. This soil has a seasonal high water table.

Most areas are used as cropland. Some are used as pasture or woodland.

If drained, this soil is suited to corn. Alfalfa is short-lived because of frost heaving and ice sheeting. Small grain is subject to lodging because of the high organic matter content and wetness of the surface layer. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness and the moderate available water capacity. Open ditches and tile drains are needed. In some areas adequate drainage outlets are not available. In other areas the growing season is short because cold air flows into the depressions. In these areas corn can be cut for silage or an early maturing variety of corn can be grown. Returning crop residue to the soil or regularly adding manure helps to maintain fertility, increases the rate of water infiltration, and improves tilth.

Unless drained, this soil is poorly suited to pasture. Grazing when the soil is too moist damages the pasture plants and increases the extent of compaction. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Wetness during the planting season limits reforestation to hand planting or natural regeneration. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Planting vigorous nursery stock reduces the seedling mortality rate. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields or dwellings because of the ponding, the slow permeability, and the high shrink-swell potential. Overcoming these limitations is difficult. A better site should be considered for these uses.

This soil is poorly suited to local roads and streets because of the ponding, low strength, and the high shrink-swell potential. These limitations can be overcome by adding coarse textured base material, such as sand and gravel, to raise the roadway above the ponding level. Culverts help to prevent road damage by equalizing the water level on each side of the road.

The land capability classification is IIw in undrained areas. The woodland ordination symbol is 4W.

RfA—Richford loamy sand, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on flats on stream terraces and outwash plains. Most areas are irregularly shaped and range from 3 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is dark yellowish brown sand about 18 inches thick. The subsoil is about 23 inches thick. It is dark brown. It is friable sandy loam in the upper part and very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand. In some places the surface layer is darker. In other places the lower part of the subsoil has mottles. In some areas a thin layer in which the content of cobbles is as much as 50 percent is at a depth of about 20 inches. In other areas depth to the substratum is less than 30 inches.

Included with this soil in mapping are small areas of the well drained Billett soils and the excessively drained Plainfield and Sparta soils. These included soils are in positions on the landscape similar to those of the Richford soil. Billett soils have a surface layer that is darker colored than that of the Richford soil. Also, they have more clay and less sand in the subsoil. Plainfield and Sparta soils are sandy throughout. Sparta soils have a dark colored surface layer that is thicker than that of the Richford soil. The included soils make up 2 to 10 percent of mapped areas.

Permeability in the Richford soil is moderately rapid and rapid in the upper part and is rapid in the lower part. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as cropland. Some are used as pasture or woodland.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Yields are limited in most years because of the low available water capacity. If the soil is cultivated, soil blowing is a hazard. It can be controlled by cover crops, field windbreaks, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface.

Many areas are used for irrigated corn, soybeans, peas, snap beans, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, the moderately rapid permeability, and the leaching of plant nutrients below the root zone of shallow-rooted plants, such as peas and potatoes. Deep-rooted crops, such as corn, can receive larger and less frequent applications of water.

Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum.

This soil is suited to pasture. In most years, however, yields are limited by the low available water capacity. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Deep-rooted legumes, such as alfalfa, grow best. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is plant competition, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the rapid permeability in the substratum. The soil is suitable as a site for dwellings and for local roads and streets.

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

RfB—Richford loamy sand, 2 to 6 percent slopes. This gently sloping, somewhat excessively drained soil is on ridgetops and knolls on stream terraces and outwash plains. Most areas are irregularly shaped and range from 3 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is dark yellowish brown sand about 16 inches thick. The subsoil is about 24 inches thick. It is dark brown. It is friable sandy loam in the upper part and very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand. In some places a thin layer in which the content of cobbles is as much as 50 percent is at a depth of about 20 inches. In other places the subsurface layer is thinner and the subsoil contains slightly more clay. In some areas depth to the substratum is less than 30 inches.

Included with this soil in mapping are small areas of Coloma and Plainfield soils. These included soils are in positions on the landscape similar to those of the Richford soil. They are excessively drained and sandy throughout. They make up 2 to 10 percent of mapped areas.

Permeability of the Richford soil is moderately rapid and rapid in the upper part and is rapid in the lower part. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as cropland. Some are used as pasture or woodland.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Yields are limited in most years by the low available water capacity. If the soil is cultivated, soil blowing and water erosion are hazards. Cover crops, field windbreaks, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface help to control soil blowing. Contour plowing and grassed waterways help to control water erosion. Cover crops, green manure crops, crop residue management, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and reduce soil loss.

Many areas are used for irrigated corn, soybeans, peas, snap beans, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, the moderately rapid permeability, and the leaching of plant nutrients below the root zone of shallow-rooted crops, such as peas and potatoes. Deep-rooted crops, such as corn, can receive larger and less frequent applications of water. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum. Other concerns in managing irrigated areas are soil blowing; the even distribution of water, fertilizer, and herbicides through the irrigation system; water erosion in the wheel tracks; and loss of organic matter.

This soil is suited to pasture. In most years, however, yields are limited by the low available water capacity. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Deep-rooted legumes, such as alfalfa, grow best. Proper stocking rates and timely deferment of grazing help keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is plant competition, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil,

but it can pollute ground water because of the rapid permeability in the substratum. The soil is suitable as a site for dwellings and for local roads and streets.

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

RfC—Richford loamy sand, 6 to 12 percent slopes. This sloping, somewhat excessively drained soil is on the sides of ridges and knolls, on stream terraces, and on outwash plains. Most areas are irregularly shaped and range from 3 to 100 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is dark yellowish brown loamy sand about 18 inches thick. The subsoil is about 21 inches thick. It is dark brown. It is friable sandy loam in the upper part and very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand. In some places a thin layer in which the content of cobbles is as much as 50 percent is at a depth of about 20 inches. In other places the subsoil contains slightly more clay. In some areas the depth to the substratum is less than 30 inches.

Included with this soil in mapping are small areas of the excessively drained Coloma and Plainfield soils. These included soils are in positions on the landscape similar to those of the Richford soil. They are sandy throughout. They make up 2 to 10 percent of mapped areas.

Permeability in the Richford soil is moderately rapid and rapid in the upper part and is rapid in the lower part. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as cropland. Some are used as pasture or woodland.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Yields are limited in most years by the low available water capacity. The soil is poorly suited to irrigation because of the runoff rate and the hazard of water erosion. If cultivated crops are grown, soil blowing and water erosion are hazards. Cover crops, field windbreaks, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface help to control soil blowing. Contour plowing and grassed waterways help to control water erosion. Cover crops, green manure crops, crop residue management, cropping systems that include grasses and legumes, and regular additions of manure increase fertility and reduce soil loss.

This soil is suited to pasture. In most years, however, yields are limited by the low available water capacity. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is plant competition, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the rapid permeability in the substratum. Because of the slope, the soil is only moderately suited to dwellings and local roads and streets. The slope can be modified by cutting and filling. Also, dwellings can be designed so that they conform to the natural slope of the land.

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

RfD—Richford loamy sand, 12 to 20 percent slopes. This moderately steep, somewhat excessively drained soil is on the sides of ridges and hills on stream terraces. Most areas are elongated and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 4 inches thick. The subsurface layer is dark yellowish brown sand about 18 inches thick. The subsoil is about 27 inches thick. It is dark brown. It is friable sandy loam in the upper part and very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand. In some places a thin layer in which the content of cobbles is as much as 50 percent is at a depth of about 20 inches. In other places depth to the substratum is less than 30 inches.

Included with this soil in mapping are small areas of the excessively drained Coloma and Plainfield soils. These included soils are in positions on the landscape similar to those of the Richford soil. They are sandy throughout. They make up 2 to 10 percent of mapped areas.

Permeability in the Richford soil is moderately rapid and rapid in the upper part and is rapid in the lower

part. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as woodland. Many areas of former cropland have been planted to pines for Christmas trees, pulpwood, poles, and sawtimber. Some areas are used for pasture. This soil is generally not used as cropland. In cultivated areas soil blowing is a hazard, the hazard of water erosion is severe, and the equipment limitation is severe because of the slope.

This soil is suited to pasture. In most years, however, yields are limited by the low available water capacity. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing and water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Deep-rooted legumes, such as alfalfa, grow best. Pasture renovation is difficult because of the slope. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The main soil-related problem in woodland management is steepness of slope. Planting on the contour helps to control water erosion. Skid roads should be properly located so that they do not increase the susceptibility to water erosion. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Because of the slope, this soil is generally not suitable as a site for septic tank absorption fields. It is poorly suited to dwellings and local roads and streets. Cutting and filling can modify the slope on sites for dwellings and local roads and streets. Dwellings can also be designed so that they conform to the natural slope of the land.

The land capability classification is IVe. The woodland ordination symbol is 4R.

SaB—Salter very fine sandy loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on ridgetops and knolls in glacial lake basins. Most areas are irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown very fine sandy loam about 7 inches thick. The next layer is yellowish brown loam about 6 inches thick. The subsoil is about 23 inches thick. It is brown and very friable. It is loam in the upper part and fine sandy loam in the lower part. The upper 6 inches of the substratum is brown silt loam. The lower part to a depth of about 60 inches is brown, mottled, stratified very fine sandy loam and silt loam. In places the surface layer is fine sandy loam or silt loam.

Included with this soil in mapping are small areas of Fisk, Tustin, and Yahara soils. Fisk and Yahara soils are somewhat poorly drained and are in the lower positions on the landscape. Tustin soils are well drained and are in positions on the landscape similar to those of the Salter soil. They are sandy in the upper part of the subsoil and clayey in the lower part of the subsoil and in the substratum. Also included are small areas that do not have mottles in the lower part of the substratum. The included soils make up 5 to 15 percent of mapped areas.

Permeability is moderate in the Salter soil. Available water capacity is high. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. This soil has a seasonal high water table.

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

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Alfalfa is short-lived because of the seasonal high water table. Plants respond well to additions of plant nutrients. If the soil is cultivated, water erosion is a slight or moderate hazard. It can be controlled by chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, by contour plowing, and by grassed waterways. Cover crops, green manure crops, crop residue management, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and reduce soil loss.

This soil is suited to pasture, but deep-rooted legumes, such as alfalfa, are short-lived because of the seasonal high water table. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in water erosion. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. The competing vegetation can be controlled by herbicides or by mechanical site preparation.

Because of wetness, this soil is poorly suited to

septic tank absorption fields. This limitation can be overcome by constructing a mound of suitable filtering material.

This soil is suitable as a site for dwellings without basements. Because of wetness, it is only moderately suited to dwellings with basements. This limitation can be overcome by adding fill material to raise the site above the level of wetness. Installing tile drains around the foundation can reduce the wetness. A dependable outlet, such as a gravity outlet, is needed.

Because of frost action, this soil is only moderately suited to local roads and streets. Covering the upper part of the soil with coarse textured base material, such as sand and gravel, can help to prevent the damage caused by frost action.

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

Sp—Sparta loamy sand, 0 to 2 percent slopes. This nearly level, excessively drained soil is on flats on outwash plains. Most areas are irregularly shaped and range from 5 to 200 acres in size.

Typically, the surface layer is black loamy sand about 12 inches thick. The subsurface layer is very dark grayish brown loamy sand about 6 inches thick. The subsoil is dark yellowish brown, very friable sand about 9 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown and light yellowish brown sand. In some places the subsoil is loamy sand. In other places a thin stratum in which the content of cobbles is as much as 50 percent is at a depth of about 18 inches.

Included with this soil in mapping are small areas of the excessively drained Plainfield and somewhat excessively drained Richford soils. These included soils are in positions on the landscape similar to those of the Sparta soil. Plainfield soils have a surface layer that is lighter colored than that of the Sparta soil. The subsoil of the Richford soils has more clay and less sand than that of the Sparta soil. The included soils make up 2 to 10 percent of mapped areas.

Permeability is rapid in the Sparta soil. Available water capacity is low. It limits the response of plants to additions of plant nutrients. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content.

Most areas are used as irrigated cropland. This soil is poorly suited to unirrigated crops. Yields are limited in most years by the low available water capacity. If the soil is cultivated, soil blowing is a hazard. It can be controlled by cover crops, field windbreaks, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface.

Irrigated areas are used for corn, soybeans, peas, snap beans, or potatoes. Light, frequent applications of water are necessary because of the low available water capacity, the rapid permeability, and the leaching of plant nutrients below the root zone of most crops. Several light applications of fertilizer during the growing season help to keep leaching losses to a minimum.

This soil is poorly suited to pasture. In most years yields are limited by the low available water capacity. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Deep-rooted legumes, such as alfalfa, grow best. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. Planting with wheeled equipment is somewhat limited by the sandy surface layer. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Septic tank effluent drains satisfactorily in this soil, but it can pollute ground water because of the rapid permeability. The soil is suitable as a site for dwellings and for local roads and streets.

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

SwA—Symco loamy fine sand, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways on moraines. Most areas are irregular or elongated in shape and range from 3 to 50 acres in size.

Typically, the surface layer is very dark brown loamy fine sand about 9 inches thick. The subsurface layer is about 8 inches thick. It is mottled. It is brown loamy fine sand in the upper part and pale brown sandy loam in the lower part. The subsoil is about 13 inches thick. It is reddish brown, mottled, and friable. It is clay loam in the upper part and loam in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled, calcareous loam. In places the surface layer and the subsurface layer are silt loam.

Included with this soil in mapping are small areas of Hortonville and Nebago soils and the Plainfield soils that have a loamy substratum. Hortonville soils are well

drained and are in the higher positions on the landscape. Nebago soils are somewhat poorly drained and are in positions on the landscape similar to those of the Symco soil. They are sandy in the upper part of the subsoil and clayey in the lower part of the subsoil and in the substratum. The Plainfield soils are excessively drained and are in the higher positions on the landscape. The included soils make up 5 to 15 percent of mapped areas.

Permeability is moderately slow in the Symco soil. Available water capacity is high. The organic matter content is moderately low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. The shrink-swell potential is moderate in the subsoil. This soil has a seasonal high water table.

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

If drained, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Alfalfa is short-lived because of frost heaving and ice sheeting. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness, unless the soil is drained. Open ditches and tile drains are needed. If the soil is cultivated, soil blowing is a hazard during dry periods. It can be controlled by field borders, field windbreaks, cover crops, vegetative row barriers, and chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface. Cover crops, green manure crops, a cropping system that includes grasses and legumes, crop residue management, and regular addition of manure increase fertility and reduce soil loss.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides and by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of wetness and moderately slow permeability. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of wetness, this soil is poorly suited to dwellings. This limitation can be overcome by adding fill material to raise the site above the level of wetness. On sites for dwellings with basements, installing tile drains around the foundation can reduce the wetness. A dependable outlet, such as a gravity outlet, is needed.

This soil is poorly suited to local roads and streets because of low strength and frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand and gravel, can overcome these limitations.

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

SyA—Symco silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways on moraines. Most areas are irregular or elongated in shape and range from 3 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is mottled, firm clay loam about 20 inches thick. It is brown in the upper part and reddish brown in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled, calcareous loam. In places the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Hortonville, Nebago, and Poygan soils. Hortonville soils are well drained and are in the higher positions on the landscape. Nebago soils are somewhat poorly drained and are in positions on the landscape similar to those of the Symco soil. They are sandy in the upper part of the subsoil and clayey in the lower part of the subsoil and in the substratum. Poygan soils are poorly drained and are in the lower positions on the landscape. Also included are small areas where the substratum has strata of silt loam and very fine sandy loam below a depth of 40 inches. The included soils make up 5 to 15 percent of mapped areas.

Permeability is moderately slow in the Symco soil. Available water capacity is high. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range of moisture content. The shrink-swell potential is moderate in the subsoil. This soil has a seasonal high water table.

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

If drained, this soil is suited to corn, soybeans, and

small grain and to grasses and legumes for hay. Alfalfa is short-lived because of frost heaving and ice sheeting. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness. In drained areas the response is good. Open ditches and tile drains are needed. Chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, green manure crops, a cropping system that includes grasses and legumes, and regular additions of manure increase fertility and maintain good tilth.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Overgrazing and grazing when the soil is too moist cause soil compaction, deplete the plant cover, and increase the extent of undesirable species. Proper stocking rates, timely deferment of grazing, and restricted use during wet seasons help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of wetness and moderately slow permeability. These limitations can be overcome by constructing a mound of suitable filtering material.

Because of wetness, this soil is poorly suited to dwellings. This limitation can be overcome by adding fill material to raise the site above the level of wetness. On sites for dwellings with basements, installing tile drains around the foundation can reduce the wetness. A dependable outlet, such as a gravity outlet, is needed.

This soil is poorly suited to local roads and streets because of low strength and frost action. Covering or replacing the upper part of the soil with coarse textured fill material, such as sand and gravel, can overcome these limitations.

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

TuB—Tustin loamy sand, 2 to 6 percent slopes. This gently sloping, well drained soil is on ridgetops and knolls in glacial lake basins and on moraines. Most areas are irregularly shaped and range from 5 to 20 acres in size.

Typically, the surface layer is brown loamy sand about 9 inches thick. The subsoil is about 32 inches thick. It is brown, very friable sand in the upper part; yellowish red, firm sandy clay loam in the next part; and reddish brown, firm clay in the lower part. The substratum to a depth of about 60 inches is reddish brown, calcareous silty clay. In places the surface layer is sand.

Included with this soil in mapping are small areas of Kewaunee, Nebago, and Plainfield soils. The well drained Kewaunee soils and the excessively drained Plainfield soils are in positions on the landscape similar to those of the Tustin soil. The surface layer and upper part of the subsoil in the Kewaunee soils have more clay and less sand than those of the Tustin soil. Plainfield soils are sandy throughout. Nebago soils are somewhat poorly drained and are in the lower positions on the landscape. Also included are small areas where the substratum is loam. The included soils make up 5 to 15 percent of mapped areas.

Permeability in the Tustin soil is rapid in the upper part of the subsoil and slow in the lower part of the subsoil and in the substratum. Available water capacity is moderate. It limits the response of plants to additions of plant nutrients. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range of moisture content. The shrink-swell potential is high in the clayey lower part of the subsoil and in the substratum.

Most areas are used as cropland. Some are used as pasture or woodland.

This soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. If the soil is cultivated, soil blowing and water erosion are hazards. Yields of deep-rooted crops are limited in most years by the moderate available water capacity. Yields of shallow-rooted crops, such as small grain and grasses, are limited by a very low available water capacity in the sandy surface layer. Chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, field borders, field windbreaks, and vegetative row barriers help to control soil blowing. Contour plowing and grassed waterways help to control water erosion. Cover crops, green manure crops, a cropping system that includes grasses and legumes, crop residue management, and regular additions of manure increase fertility and reduce soil loss.

This soil is suited to pasture. Deep-rooted legumes, such as alfalfa, grow best. Overgrazing depletes the plant cover, increases the extent of undesirable species, and results in soil blowing. Proper stocking rates and timely deferment of grazing help to keep the

pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is plant competition, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of slow permeability in the lower part of the subsoil and in the substratum. Septic tank effluent drains satisfactorily in the sandy subsoil, but it can pollute ground water because of the rapid permeability. A mound of suitable filtering material is added.

This soil is suited to dwellings without basements. It is poorly suited to dwellings with basements because of the high shrink-swell potential. This limitation can be overcome by placing coarse textured fill material, such as sand and gravel, under the foundation and by backfilling around the foundation with this material.

Because of frost action, this soil is only moderately suited to local roads and streets. Covering the soil with coarse textured fill material, such as sand and gravel, helps to prevent the damage caused by frost action.

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

Wm—Willette muck, 0 to 1 percent slopes. This nearly level, very poorly drained soil is in depressions in glacial lake basins. It is subject to ponding. Most areas are elongated or irregular in shape and range from 5 to 250 acres in size.

Typically, the organic layer is black muck about 31 inches thick. The substratum to a depth of about 60 inches is gray and brown, mottled, calcareous clay. In some places the substratum is silt loam or sand. In other places the muck layer is more than 51 inches thick.

Included with this soil in mapping are small areas of Poy and Poygan soils. These soils are poorly drained and are in the slightly higher positions on the landscape. Poy soils formed in clayey deposits over sand. Poygan soils are dominantly clayey throughout. Also included are small areas where as much as 10 inches of marl overlies the clay substratum. The included soils make up 2 to 10 percent of mapped areas.

Permeability in the Willette soil is moderately slow to moderately rapid in the muck layer and is slow in the substratum. Available water capacity is very high. The organic matter content is very high in the muck layer. This soil has a seasonal high water table.

Most areas support native vegetation. The main plants are water-tolerant trees, marsh grasses, cattails, sedges, reeds, redosier dogwood, and alder. A few areas are drained and used for corn or specialty crops, such as carrots and lettuce.

This soil is poorly suited to use as cropland. Many areas do not have adequate drainage outlets. The hazard of ponding and a short growing season, which is caused by cold air flowing into depressions, limit yields and restrict the kinds of crops that can be grown. Wetness and the soft muck limit the use of farm equipment. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness. Soil blowing and subsidence are hazards in drained areas.

This soil is generally not used as pasture. Organic soils are easily cut by hooves of cattle; therefore, grazing is restricted to dry periods.

This soil is suited to trees. Wetness during the planting season generally limits reforestation to natural regeneration. The trees generally can be harvested only when the soil is frozen. Harvesting by clear-cutting or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is generally not suitable as a site for septic tank absorption fields, dwellings, or local roads and streets. The main management concerns are ponding, low stability, a high shrink-swell potential, the slow permeability, and the hazard of frost damage. Overcoming these limitations is difficult. A better site should be considered for these uses.

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

YaA—Yahara very fine sandy loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways in glacial lake basins. Most areas are irregularly shaped and range from 3 to 50 acres in size.

Typically, the surface layer is very dark brown very fine sandy loam about 8 inches thick. The subsoil is mottled, friable silt loam about 24 inches thick. It is yellowish brown in the upper part and brown in the lower part. The substratum to a depth of about 60 inches is stratified, light brownish gray and brown, mottled, calcareous silt and silt loam. In places the surface layer is silt loam.

Included with this soil in mapping are small areas of Fisk, Keowns, and Salter soils. Fisk soils are somewhat poorly drained and are in positions on the landscape similar to those of the Yahara soil. The upper part of the Fisk soils has more sand than that of the Yahara soil. Keowns soils are poorly drained and are in the slightly lower positions on the landscape. Salter soils are moderately well drained and are in the higher positions on the landscape. The included soils make up 5 to 15 percent of mapped areas.

Permeability is moderate in the Yahara soil. Available water capacity is high. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range of moisture content. This soil has a seasonal high water table.

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

If drained, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Alfalfa is short-lived because of frost heaving and ice sheeting. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by wetness. In drained areas, the response is good. Open ditches and tile drains are needed. Ditchbanks are subject to sloughing and water erosion. If drainage tile is used, silt enters the tile lines unless a suitable filter covers the tile. Some areas of this soil have a short growing season caused by cold air flowing into depressions. In these areas corn can be cut for silage or an early maturing variety can be grown. Returning crop residue to the soil or regularly adding manure increases fertility.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Overgrazing depletes the plant cover and increases the extent of undesirable species. Proper stocking rates and timely deferment of grazing help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. Plant competition can be controlled by herbicides or by mechanical site preparation.

Because of the wetness, this soil is poorly suited to septic tank absorption fields and dwellings. On sites for absorption fields, this limitation can be overcome by constructing a mound of suitable filtering material. On sites for dwellings, it can be overcome by adding fill material to raise the site above the level of wetness. On sites for dwellings with basements, installing tile drains around the foundation can reduce the wetness. A dependable outlet, such as a gravity outlet, is needed.

Because of frost action, this soil is poorly suited to local roads and streets. Covering or replacing the upper part of the soil with coarse textured base material, such as sand and gravel, helps to prevent the damage caused by frost action.

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

ZtA—Zittau clay, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways in glacial lake basins. Most areas are irregularly shaped and range from 3 to 50 acres in size.

Typically, the surface layer is dark brown clay about 9 inches thick. The subsoil is reddish brown, mottled, firm clay about 7 inches thick. The upper part of the substratum to a depth of about 23 inches is reddish brown, mottled, calcareous clay. The lower part of the substratum to a depth of about 60 inches is brown, mottled loamy sand and light brown, mottled sand. In places the surface layer is loamy sand.

Included with this soil in mapping are small areas of Nebago and Poy soils. Nebago soils are somewhat poorly drained and are in positions on the landscape similar to those of the Zittau soil. They are sandy in the upper part of the subsoil and clayey in the lower part of the subsoil and in the substratum. Poy soils are poorly drained and are in the lower positions on the landscape. Also included are small areas that are moderately well drained. The included soils make up 5 to 15 percent of mapped areas.

Permeability in the Zittau soil is slow in the clayey subsoil and upper part of the substratum and is rapid in the sandy lower part of the substratum. Available water capacity is low. The organic matter content is moderate in the surface layer. This layer is firm and clayey. Clods form if the soil is tilled when it is too moist. The shrink-swell potential is high in the clayey subsoil and the upper part of the substratum and low in the sandy lower part of the substratum. This soil has a seasonal high water table.

Most areas are used as cropland. Some are used as pasture or woodland.

If drained, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Yields are limited in most years by the low available water capacity. Alfalfa is short-lived because of frost heaving

and ice sheeting. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness and the low available water capacity. Open ditches and tile drains are needed. Ditchbanks are subject to sloughing and water erosion. If drainage tile is installed, sand enters the tile lines unless a suitable filter covers the tile. Following heavy rains, the soil is subject to crusting, which results in poor emergence of small-seeded crops. Chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, green manure crops, and regular additions of manure help to maintain fertility, increase the rate of water infiltration, and improve tilth.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Grazing when the soil is too moist damages the pasture plants and increases soil compaction. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The soil-related problems in woodland management are equipment limitations, seedling mortality, and the hazard of windthrow. Use of wheeled equipment in planting and harvesting is limited by the clay in the upper part of the soil. Planting vigorous nursery stock reduces the seedling mortality rate. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

This soil is poorly suited to septic tank absorption fields because of wetness and slow permeability in the subsoil and the upper part of the substratum. These limitations can be overcome by constructing a mound of suitable filtering material.

This soil is poorly suited to dwellings because of the wetness and the high shrink-swell potential in the subsoil and upper part of the substratum. On sites for dwellings without basements, these limitations can be overcome by covering or replacing the upper part of the soil with coarse textured fill material, such as sand and gravel. On sites for dwellings with basements, the limitations can be overcome by adding coarse textured fill material to raise the site above the level of wetness. A tile drain and a gravity or other dependable outlet around the foundation can reduce the wetness.

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

The land capability classification is IIw. The woodland ordination symbol is 3C.

ZvA—Zittau Variant clay, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in drainageways in glacial lake basins. Most areas are irregularly shaped and range from 5 to 60 acres in size.

Typically, the surface layer is dark brown clay about 8 inches thick. The subsoil is about 14 inches thick. It is reddish brown, firm clay in the upper part; reddish brown, mottled, firm clay in the next part; and brown, mottled, friable clay loam in the lower part. The substratum to a depth of about 60 inches is light brownish gray, mottled, calcareous silt loam. In some places the surface layer is silty clay loam. In other places the substratum is stratified silt loam and very fine sandy loam or is sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Manawa and Yahara soils. These soils are in positions on the landscape similar to those of the Zittau Variant soil. Manawa soils have a substratum that has more clay than that of the Zittau Variant soil. The surface layer and subsoil of the Yahara soils have more silt and less clay than those of the Zittau Variant soil. The included soils make up 5 to 15 percent of mapped areas.

Permeability in the Zittau Variant soil is slow in the subsoil and moderate in the substratum. Available water capacity is high. The organic matter content is moderate in the surface layer. This layer is firm and clayey. Clods form if the soil is tilled when it is too moist. The shrink-swell potential is high in the subsoil. This soil has a seasonal high water table.

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

If drained, this soil is suited to corn, soybeans, and small grain and to grasses and legumes for hay. Alfalfa is short-lived because of frost heaving and ice sheeting. Following heavy rains, the soil is subject to crusting, which results in poor emergence of small-seeded crops. Unless the soil is drained, the rooting depth of most plants is limited by the seasonal high water table. The response of plants to additions of plant nutrients is limited by the wetness. Open ditches and tile drains are needed. Ditchbanks are subject to sloughing and water erosion. If drainage tile is installed, silt enters the tile

lines unless a suitable filter covers the tile. Chisel plowing or other kinds of conservation tillage that leave all or part of the crop residue on the surface, green manure crops, and regular additions of manure help to maintain fertility, increase the rate of water infiltration, and improve tilth.

This soil is suited to pasture, but the number of suitable forage plants is limited by the seasonal high water table. Grazing when the soil is too moist damages pasture plants and increases soil compaction. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. Clipping and mowing help to offset the effects of uneven grazing, control weeds and brush, spread manure, and achieve uniform regrowth. Topdressing with fertilizer helps to maintain a productive stand of high-quality forage.

This soil is suited to trees. The soil-related problems in woodland management are equipment limitations, seedling mortality, and the hazard of windthrow. Use of wheeled equipment in planting and harvesting is limited by the clay in the upper part of the soil. Planting vigorous nursery stock reduces the seedling mortality rate. Harvesting by clear-cut or area-selection methods helps to prevent windthrow of the remaining trees. Plant competition following harvest can be controlled by herbicides or by mechanical site preparation.

Because of wetness, this soil is poorly suited to septic tank absorption fields and dwellings. On sites for absorption fields, this limitation can be overcome by constructing a mound of suitable filtering material. On sites for dwellings, it can be overcome by adding fill material to raise the site above the level of wetness. On sites for dwellings with basements, installing tile drains around the foundation can reduce the wetness. A dependable outlet, such as a gravity outlet, is needed.

Because of frost action, this soil is poorly suited to local roads and streets. Covering or replacing the upper part of the soil with coarse textured base material, such as sand and gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 3C.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 75,000 acres in Waushara County, or nearly 19 percent of the land area, is prime farmland. This land is in scattered areas throughout the county, but most of it is in associations 5 and 7, which are described under the heading "General Soil Map Units." Nearly all of the prime farmland is used for crops, mainly corn, oats, and alfalfa.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this

limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Daniel E. Chelmo, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1982, about 185,788 acres in Waushara County was in farms. Of this total, about 133,000 acres was cropland, 4,000 acres was pastureland, 32,000 acres was woodland, and the rest was in other farm uses. The acreage used as cropland has been gradually decreasing as more land has been used for urban development and roads. Since 1950, about 18,000 acres has been converted from cropland to other uses. Some of this acreage was marginal cropland and is now used for pasture or has been planted to trees.

The potential for increasing the acreage of cropland in Waushara County is fair to good. If proper conservation practices are applied, an estimated 30,000 additional acres could be used as cropland. This acreage is presently used for pasture, woodland, or other purposes. The productive capacity of all cropland can be increased by applying the latest crop production technology. The paragraphs that follow describe the main concerns in managing the cropland in the county.

Water erosion is the major problem on about two-thirds of the cropland in Waushara County. Soils that have slopes of more than about 2 percent are subject to erosion.

Water erosion is damaging for three main reasons. Firstly, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Kewaunee soils. Sandy soils, such as Coloma and Plainfield, are

damaged because infertile sand containing little or no organic matter is exposed. Erosion also damages soils that have a layer that limits the rooting depth; for example, the layer of sand and gravel in the Billett and Boyer soils.

Secondly, water erosion adversely affects the tilth and water infiltration rate of the soils. In many eroded soils the upper part of the subsoil has been incorporated into the plowed layer. As a result, the clay content of the plowed layer generally has increased and tillage is more difficult. Puddling and crusting, which contribute to poor seedling emergence, are more common in eroded soils than in uneroded soils.

Thirdly, water erosion results in sedimentation. Control of water erosion reduces the amount of sediment entering streams, rivers, and lakes and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Measures that control water erosion provide a protective surface cover, reduce the runoff rate, and increase the rate of water infiltration. Using a cropping system that keeps a plant cover on the soil for extended periods can reduce water erosion. Including legume and grass forage crops in the cropping system reduces water erosion and improves the tilth for the next crop in the rotation. Legumes also add nitrogen to the soil.

Slopes of some of the soils in Waushara County are so short and irregular that contour stripcropping or terracing is not practical. On these soils cropping systems that provide a substantial plant cover are required to control water erosion. Conservation tillage practices can be adapted to most of the soils in Waushara County. Minimizing tillage and leaving crop residue on the surface increase water infiltration rates and reduce the risks of runoff and water erosion. No-till farming is effective in reducing water erosion and can be adapted to most of the soils in Waushara County. Delaying plowing until spring or growing cover crops is also effective. Fall plowing leaves the surface exposed for extended periods. Winter wind and spring runoff remove excessive amounts of the surface layer if the plant cover has been removed.

Constructing terraces shortens the length of slopes and thus reduces the risks of runoff and water erosion. This practice is most easily applied on deep, well drained soils that have uniform slopes. It is suited to many of the soils in Waushara County.

Contour cropping and contour stripcropping help to control water erosion in some parts of the county. They are best suited to soils that have long, uniform slopes.

Soil blowing is a hazard on all of the soils in the county, especially on sandy soils, such as Coloma, Plainfield, and Tustin. Soil blowing is also a hazard on organic soils that are cultivated. It can cause severe damage in a few hours if winds are strong. Soils that are smooth, dry, and bare of vegetation or crop residue are more susceptible to soil blowing than other soils. Maintaining a plant cover or crop residue on the surface minimizes soil losses. Windbreaks are also effective in reducing soil losses.

A drainage system is the major management practice needed on about one-third of the cropland in Waushara County. Unless artificially drained, the somewhat poorly drained and poorly drained soils are so wet that crops are damaged during most years. Among the soils in this group are Fisk, Keowns, Kingsville, Manawa, Meehan, Morocco, Nebago, Poy, Poygan, Symco, and Yahara soils.

The design of both surface and subsurface drainage systems varies with each kind of soil and site condition. A combination of surface and subsurface drains is needed in most areas of poorly drained soils that are used as cropland. The drains must be more closely spaced in slowly permeable soils than in the more permeable soils. Locating gravity outlets for subsurface drainage systems is difficult in some areas of poorly drained soils.

Organic soils are among the wet soils in the county. Special drainage systems are needed on these soils to control the depth and period of drainage. These soils oxidize and subside after water has drained from the pore spaces. Keeping the water table at a level low enough for crops during the growing season and raising it to the surface during other parts of the year minimize oxidation and subsidence.

Kewaunee soils are characterized by good natural drainage, but they tend to dry out slowly after rains because of a high clay content. Water may collect on the lower slopes following heavy rains because of slow permeability.

Sandy soils, such as Kingsville, Meehan, and Morocco soils, are seasonally wet, generally in spring. During the growing season the water table drops and these soils become droughty. The droughtiness causes severe moisture stress in crops during the latter part of the growing season. To achieve the best crop production on these soils, surface drains are necessary to remove excess water in spring and irrigation is needed to maintain adequate soil moisture during the rest of the growing season. Maintaining crop residue on the surface throughout the year conserves soil moisture for crops by reducing losses from evaporation.

Installing a drainage system in somewhat poorly drained and poorly drained soils increases the length of

the growing season. Soils that are adequately drained can be tilled earlier in spring than can undrained soils, and they reach a soil temperature that is favorable for plant growth earlier in the growing season.

Soil fertility is naturally low or medium in most of the upland soils in the county. Fertility can be improved by choosing a cropping system that adds organic matter to the soils and by applying commercial fertilizer. On dairy farms, using a diversified cropping system and applying manure help to maintain the organic matter content. Where specialty crops, such as potatoes, are grown, green manure crops are needed to maintain the organic matter content.

Commercial fertilizer results in higher yields of most crops. Generally, the subsoil of the mineral soils in the western part of the county has a moderate phosphorus content and is low in potassium. These soils commonly are slightly acid to strongly acid. Generally, the subsoil of the soils in the eastern part of the county is low in both phosphorus and potassium. They are commonly neutral or slightly acid. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields.

Soil tilth is an important factor affecting seedling emergence and seedbed preparation. It is affected by the amount of clay and organic matter in the surface layer. Both of these characteristics are affected by erosion. In the western part of the county, erosion has little effect on tilth because the subsoil has nearly the same texture as the surface layer. In contrast, the tilth of the soils in the eastern part of the county is severely affected by erosion. The subsoil of the soils in this part of the county is mostly silty clay loam or clay. When incorporated into the plowed layer, it increases the clay content of that layer. These eroded areas are also subject to crusting following intense rains. The crust is hard when dry and is nearly impervious to water. It reduces the infiltration rate and increases the runoff rate. Also, the emergence of small-seeded crops is restricted by this crust. Regular additions of crop residue and manure can improve soil structure and minimize crusting.

The somewhat poorly drained and poorly drained soils in the county have a moderately low to high organic matter content and generally have a darker colored surface layer than do the well drained soils. They are less likely to form a crust than the well drained upland soils that have less organic matter in the surface layer.

The nearly level Billett, Plainfield, Richford, and Sparta soils are suitable for irrigation. These soils have a low available water capacity and are rapidly or moderately rapidly permeable. They require additions of water for sustained high crop yields. They are well suited to sprinkler irrigation. In 1982, about 37,000 acres in the county was irrigated. Since then, an additional acreage has been irrigated, and it is expected that the irrigated acreage will continue to increase for many years. Most of the irrigated areas are used for specialty crops, such as potatoes, snap beans, and peas. The use of irrigation for common farm crops is gaining in importance throughout the county. As the value of cropland increases, the amount of land irrigated for common crops is expected to increase.

An irrigation system has very little effect on the yields of crops grown on the commonly irrigated soils. The largest difference is on the more droughty soils because they are subject to greater evapotranspiration. Although yields are about the same under a high level of management, the amount of water and fertilizer needed varies greatly among soils. Soils that have a loamy subsoil, such as Billett soils, have a capacity to store water for plants. This loamy layer also reduces the likelihood that plant nutrients and pesticides will be leached to a depth below the root zone. Soils that are sandy throughout, such as Plainfield soils, require light, frequent applications of fertilizer and water to prevent leaching and to provide ample water for plant growth.

Gently sloping soils present additional problems where irrigated. The even distribution of water, fertilizer, and herbicides is more difficult to control on sloping soils. There is an additional hazard of erosion in the wheel tracks when large amounts of water are added. This hazard can be reduced by light, frequent applications of water.

The water for irrigation is from high capacity wells or ground water ponds. Most areas that are suitable for irrigation have an ample supply of ground water available for irrigation. Waushara County has about 60,000 acres that is suited to irrigation but is now cropped without irrigation.

Field crops suited to the soils in Waushara County include many crops that are not commonly grown. Corn is the most extensively grown row crop. Grain sorghum, sunflowers, soybeans, sugar beets, snap beans, cucumbers, sweet corn, and similar row crops can be grown if economic conditions are favorable.

Oats and rye are the commonly grown small-grain crops. Wheat and barley are also grown when economic conditions are favorable. Grass and legume seed can be harvested from alfalfa, timothy, red clover, bromegrass, fescue, and bluegrass, which are also commonly grown hay crops.

Specialty crops grown commercially are vegetables, small fruit, tree fruit, gladioli, and nursery stock. Potatoes, snap beans, peas, and sweet corn are the commonly grown vegetable crops. Other vegetable crops include cucumbers, cabbage, lettuce, carrots, and tomatoes. Many similar types of vegetable and fruit crops are grown under irrigation when markets are favorable.

Nearly 30,000 acres of mucky soils in the county have potential for specialty crops, such as cranberries or mint. These are the Adrian, Houghton, Palms, and Willette soils. Most areas of these soils are presently undrained and remain in their natural vegetation. These soils would require a drainage system and careful crop selection. The growing season between frosts late in spring and early in fall is quite short because of cold air drainage into the depressions where these soils occur. These soils are low in natural fertility and are subject to subsidence and soil blowing when drained and cultivated.

The county has two types of pasture—rotation pasture and perennial or permanent pasture. Rotation pastures are areas that are used for cultivated crops in some years and for pasture in 1 year or more as part of the cropping system. They generally support a grass-legume mixture, such as bromegrass-alfalfa. Perennial pastures support perennial pasture plants, such as bluegrass. This kind of pasture remains unplowed for many years and generally is in areas where slopes are more than 15 percent.

The management practices are similar for both types of pasture. Proper stocking rates, pasture rotation, timely deferment of grazing, clipping and mowing, and restricted use during wet periods help to keep the pasture in good condition. Renovation of perennial or permanent pasture with higher yielding pasture plants, such as bromegrass and alfalfa, is desirable if erosion can be controlled. Additions of lime and fertilizer will increase yields on both types of pasture. Draining wet soils improves forage yields and widens the range of pasture species that can be selected for planting.

Yields Per Acre

Dennis Dornfield, agricultural agent, University of Wisconsin Extension Service, helped prepare this section.

The average yields per acre that can be expected of the principal crops under a high level of management are shown in tables 6 and 7. 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 the map units 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 are also considered *(5)*.

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 6 and 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management *(12)*. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability

and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations or hazards that restrict their use.

Class II soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations or hazards that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations or hazards that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yield tables.

Woodland Management and Productivity

George W. Alley, forester, Soil Conservation Service, helped prepare this section.

Most of Waushara County was originally an open oak forest with an understory of prairie grasses and other prairie plants. A minor acreage in the eastern part of the county was a mixed hardwood forest *(4)*.

Almost all of the forest land in Waushara County is privately owned—45 percent by farmers and 51 percent by nonfarm individuals or corporations. The rest is administered by state and local units of government. Only 300 acres is industrial forest.

Clearing for agriculture and other uses has reduced the present forest to 119,300 acres, or about 30 percent of the land area. Most of this acreage is commercial forest *(16)*.

The oak-hickory timber type, dominated by northern pin oak, makes up about 36 percent of the commercial forest; conifers, which include natural stands of jack pine and white pine, Christmas tree plantations of various species, and red pine plantations, make up about 23 percent; and the aspen-white birch type makes up about 19 percent. These types are on the well drained to excessively drained, sandy soils throughout the county. The maple-beech-birch type, which is limited to medium textured soils in the eastern part of the county, makes up about 10 percent of the forested areas. The elm-ash-cottonwood type, which grows on poorly drained soils scattered throughout the county, makes up about 8 percent of the forest. About 4 percent of the forest land is nonstocked.

The greatest forest management need is for removal of defective trees and the less valuable tree species. Management measures have been applied on less than half of the forest in the county.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The

letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 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, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in 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 is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production. Additional information about woodland management and productivity can be obtained from the Wisconsin Department of Natural Resources or from the local office of the Soil Conservation Service or of the Cooperative Extension Service.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards

from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service, the Wisconsin Department of Natural Resources, or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock 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, Soil Conservation Service, helped prepare this section.

The essential habitat elements available to a selected species of wildlife generally depends on the properties of several kinds of soil and the prevailing land uses. The diversity of land uses in Waushara County results in numerous habitat types, enabling the county to support an abundant and varied fish and wildlife community. On the basis of land use and kinds of soil, the county has been divided into wildlife areas.

In the following paragraphs the eight associations described under the heading "General Soil Map Units" are grouped into six wildlife areas. Although there are no clear-cut lines and a great deal of overlap of wildlife species occurs, these associations can generally be described in terms of the wildlife they produce.

Wildlife area 1 occurs as the Plainfield-Okee-Richford association. Most of this area is abandoned farmland or upland woods, but there are some areas of wooded swamps. There are several pothole lakes that are used by waterfowl, primarily during migration. There are many trout streams in this area.

Because of the diversity of the area and the presence of woody vegetation, this area has the largest population of white-tailed deer and ruffed grouse in the county. Other game species include cottontail rabbits and gray squirrels. There are mink, otter, muskrats, and beaver along the streams.

Wildlife area 2 consists of the Plainfield-Richford-Boyer and Kingsville-Meehan associations. Most areas in the western part of the county are irrigated cropland. Because of the large fields associated with center-pivot irrigation, there is not much habitat diversity to support a varied and abundant wildlife population in this area. There is some opportunity to improve habitat by planting field corners to grass and shrubs and by planting grass, shrub, and tree barriers in and around fields to help control crop damage and soil blowing. Brushy wetlands that have not been converted to cropland provide some habitat diversity and are important to white-tailed deer, cottontail rabbits, and several species of songbirds.

In other parts of this area, the land is largely abandoned cropland or woodland. There are few good wetlands. Because of the low content of organic matter and droughtiness of these soils, short grass is the predominant vegetation growing on the abandoned cropland. These fields are used by some ground nesting birds, and they provide habitat for mice and other small mammals that are used as food by hawks, owls, fox, and other predator species. Wildlife species in the wooded areas include white-tailed deer, cottontail rabbits, ruffed grouse, raccoons, and gray squirrels.

Several trout streams in this area provide habitat for mink, otter, muskrat, and beaver.

Wildlife area 3 occurs as the Houghton-Adrian-Willette association. This area consists of very poorly drained, organic soils. Only about 1 percent of this area is cropped. Most of the land is open wet meadows *(8)* of canarygrass and sedges. These meadows provide some nesting areas for ducks and pheasants. Also, some large areas of dogwood swamps provide good winter cover for pheasants.

Wildlife area 4 occurs as the Hortonville-Symco-Manawa association. Most of this area is used for crops, mainly corn, oats, and alfalfa. Fence rows are common, as are wet drainageways. About 15 percent of the area is wooded. There is fairly good habitat variety in this area, and the potential is good for improving habitat by management measures such as planting winter food plots and hedgerows and increasing the extent of grass nesting cover. Wildlife species include white-tailed deer, ruffed grouse, cottontail rabbits, gray squirrels, red fox, raccoon, and badgers. There are also pheasants in this area.

Wildlife area 5 occurs as the Plainfield-Pearl-Leola association. Nearly all of this area is irrigated cropland. It is less than 5 percent woodland and includes almost no wetlands. There are few fence rows to provide cover. Because of these conditions, resident wildlife populations are very low in all parts of this area, except for those near the boundary with wildlife area 1.

Wildlife area 6 consists of the Poy-Zittau-Poygan and Morocco-Kingsville-Keowns associations. About 60 percent of this area is cultivated, 20 percent is woodland, and 20 percent is wetlands. Because of this mixture, food and cover are available for many wildlife species, such as white-tailed deer, cottontail rabbits, gray squirrels, ruffed grouse, muskrats, mink, and otter. Some mallards, blue-winged teal, and wood ducks nest in this area. This area also has a fairly large population of pheasants.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated

according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bluegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, switchgrass, goldenrod, beggarweed, tickclover, 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, aspen, poplar, cherry, maple, basswood, apple, hawthorn, dogwood, hickory, blackberry, and blueberry.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl-feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include hungarian partridge, pheasant, meadowlark, bluebird, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, red 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

Robert E. Wilson, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without

basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, 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 or to a cemented pan, 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 or to a cemented pan, 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 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 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 or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to

function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, 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, and bedrock.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water high table that is 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 15 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, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, 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 or to a cemented pan. The performance of a system is affected by the depth of the root zone and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce water erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan 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 or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

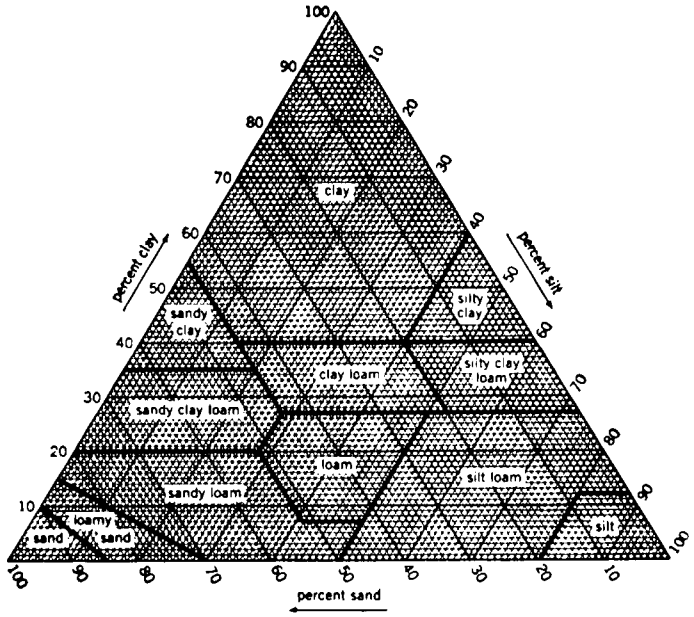

Figure 6.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 6). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering

properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH

of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous, loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, 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 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 18 shows the expected total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field

capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(13)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Psamment (*Psamm*, meaning sand, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Udipsamments (*Ud*, meaning humid, plus *psamment*, the suborder of the Entisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Udipsamments.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is mixed, mesic Typic Udipsamments.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (11)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (13)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Adrian Series

The Adrian series consists of very poorly drained soils on outwash plains or in glacial lake basins. These soils formed in muck 16 to 51 inches deep over sand. Permeability is moderately rapid to moderately slow in the muck layer and rapid in the substratum. Slope is 0 to 1 percent.

Typical pedon of Adrian muck, 0 to 1 percent slopes, approximately 1,200 feet south and 40 feet west of the northeast corner of sec. 33, T. 20 N., R. 8 E.

Oa1—0 to 20 inches; sapric material, black (N 2/0) broken face, rubbed, and pressed; less than 5 percent fiber, unrubbed and rubbed; weak coarse subangular blocky structure; slightly sticky; many fine and few medium roots to a depth of 15 inches and few medium roots to a depth of 20 inches; neutral; abrupt wavy boundary.

Oa2—20 to 32 inches; sapric material, black (10YR 2/1) broken face, rubbed, and pressed; about 28 percent fiber, less than 5 percent rubbed; weak coarse subangular blocky structure; slightly sticky; neutral; abrupt wavy boundary.

C1—32 to 42 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; about 3 percent gravel; neutral; abrupt wavy boundary.

C2—42 to 60 inches; dark gray (10YR 4/1) sand; single grain; loose; about 5 percent gravel; some pale brown (10YR 6/3) sand grains; neutral.

Depth to the sandy C horizon ranges from 16 to 51 inches. The organic material is primarily herbaceous, but some layers contain as much as 10 percent woody material.

The surface tier is neutral or has hue of 10YR, value of 2 or 3, and chroma of less than 2, broken face or rubbed. Some pedons have a layer of hemic material, 1 to 2 inches thick, on the surface. The subsurface tier and bottom tier are neutral or have hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2, broken face or rubbed. In some pedons thin layers of hemic material less than 4 inches thick occur in these tiers. In some pedons a thin sapric layer that contains as much as 20 percent, by volume, mineral material is directly above the C horizon. The C horizon is dominantly sand, but some pedons have thin strata of loamy sand or fine sand. The content of gravel in this horizon ranges from 0 to 10 percent.

Belleville Series

The Belleville series consists of poorly drained soils in glacial lake basins. These soils formed in sandy deposits over silty or loamy deposits. Permeability is rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Belleville loamy sand, 0 to 2 percent slopes, approximately 1,000 feet south and 200 feet east of the northwest corner of sec. 9, T. 19 N., R. 13 E.

Ap—0 to 10 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak medium granular structure; very friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

Bg—10 to 26 inches; grayish brown (10YR 5/2) sand; few fine prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; neutral; clear wavy boundary.

C1—26 to 30 inches; brown (10YR 5/3) sand; single grain; loose; about 1 percent gravel; sand grains are uncoated; neutral; abrupt wavy boundary.

2C2—30 to 60 inches; reddish brown (5YR 5/3) silty clay loam; massive; firm; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 24 to 38 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is typically sand, but some pedons have thin subhorizons of fine sand or loamy fine sand. The 2C horizon is dominantly silty clay loam or clay loam but has thin strata of loam in some pedons.

Billett Series

The Billett series consists of well drained soils on outwash plains (fig. 7). These soils formed in loamy and sandy deposits over outwash sand and gravel. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Billett sandy loam, 0 to 2 percent slopes, approximately 2,240 feet south and 600 feet west of the northeast corner of sec. 35, T. 20 N., R. 9 E.

Ap—0 to 8 inches; black (10YR 2/1) sandy loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; friable; many fine roots; about 1 percent gravel and 1 percent cobbles; slightly acid; abrupt smooth boundary.

BA—8 to 11 inches; dark brown (10YR 3/3) sandy

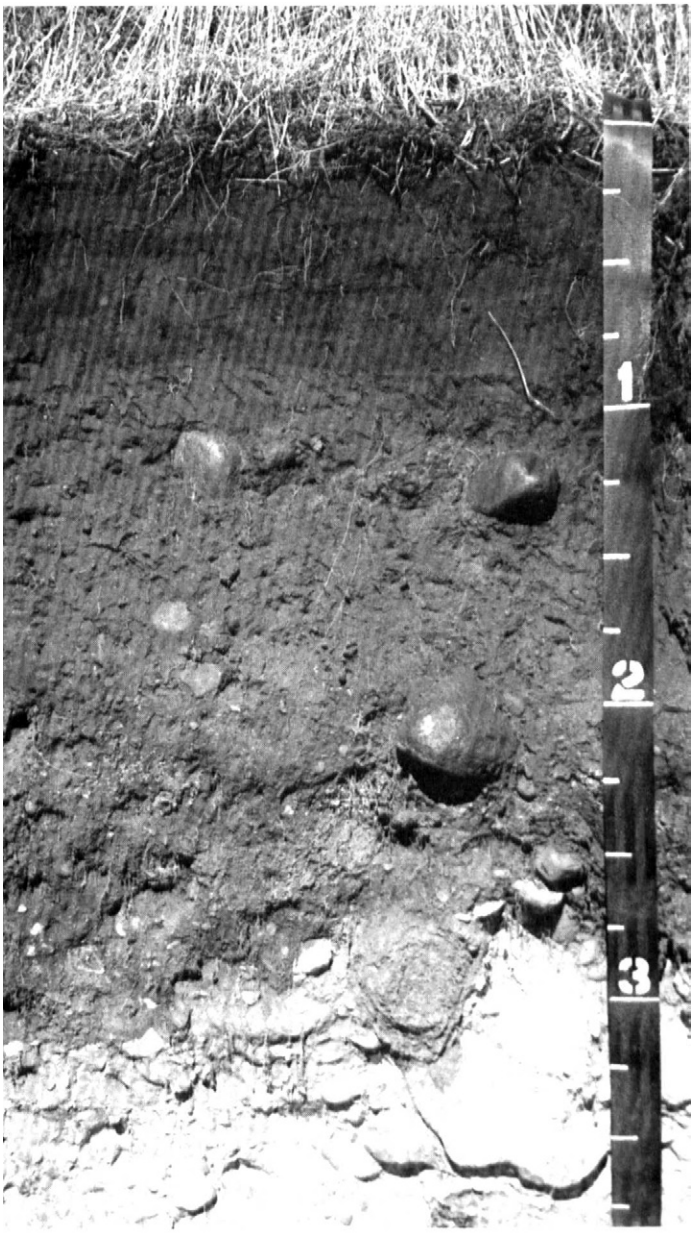

Figure 7.—Profile of a Billett soil that has an 11-inch-thick surface layer and common cobbles in the subsoil and substratum. Depth is marked in feet.

loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; many fine roots; about 3 percent gravel and 10 percent cobbles; slightly acid; abrupt wavy boundary.

Bt1—11 to 28 inches; brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; many fine roots; thin faint continuous reddish brown (5YR 4/4) clay films on faces of peds; about 6 percent gravel and 4 percent cobbles; strongly acid; abrupt wavy boundary.

Bt2—28 to 31 inches; brown (7.5YR 4/4) gravelly loamy sand; weak fine subangular blocky structure; very friable; many fine roots; clay bridges between mineral grains; about 25 percent gravel and 10 percent cobbles; neutral; abrupt wavy boundary.

C—31 to 60 inches; light yellowish brown (10YR 6/4) very gravelly sand; single grain; loose; few fine roots in the upper part; about 40 percent gravel and 10 percent cobbles; slightly effervescent from dolomite fragments; mildly alkaline.

The thickness of the solum ranges from 30 to 40 inches. The content of gravel ranges from 2 to 10 percent in the upper part of the subsoil, from 5 to 25 percent in the lower part, and from 10 to 40 percent in the substratum. The content of cobbles ranges from 4 to 10 percent in the subsoil and substratum.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The BA horizon has value of 3 to 5 and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam in the upper part and gravelly loamy sand or gravelly sandy loam in the lower part. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. It is typically very gravelly sand, but some pedons have thin strata of loamy sand or sand.

Boyer Series

The Boyer series consists of well drained soils on outwash plains and moraines. These soils formed in sandy and loamy deposits over sand or gravelly sand. Permeability is moderately rapid in the subsoil and very rapid in the substratum. Slope ranges from 2 to 20 percent.

Typical pedon of Boyer loamy sand, 2 to 6 percent slopes, approximately 25 feet north and 1,200 feet east of the southwest corner of sec. 15, T. 18 N., R. 11 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; few fine roots; about 2 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—8 to 10 inches; brown (7.5YR 4/4) loamy sand; weak coarse subangular blocky structure; very friable; few fine roots; common faint clay bridges between mineral grains; about 3 percent gravel; slightly acid; clear wavy boundary.

Bt2—10 to 18 inches; brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine vesicular and many fine irregular pores; common faint dark brown (7.5YR 4/4) clay films on faces of peds; about 3 percent gravel and 4 percent cobbles; slightly acid; clear wavy boundary.
BC—18 to 22 inches; strong brown (7.5YR 5/6) loamy sand; weak coarse subangular blocky structure; very friable; about 3 percent gravel and 4 percent cobbles; neutral; clear wavy boundary.
C—22 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; about 5 percent gravel and 4 percent cobbles; slightly effervescent; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The content of gravel ranges from 2 to 20 percent in the solum and substratum. The content of cobbles ranges from 0 to 4 percent in the solum and from 2 to 5 percent in the substratum.

The Ap horizon has value of 3 or 4. The E horizon, where it occurs, has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is typically loamy sand, but in some pedons it is gravelly loamy sand. The Bt horizon has hue of 7.5YR or 10YR. The C horizon has value of 5 or 6 and chroma of 2 to 4. It is gravelly sand or sand.

Coloma Series

The Coloma series consists of excessively drained, rapidly permeable soils on moraines. These soils formed in sandy glacial drift. Slope ranges from 2 to 30 percent.

Typical pedon of Coloma loamy sand, 2 to 6 percent slopes, approximately 400 feet south and 1,150 feet west of the northeast corner of sec. 29, T. 18 N., R. 8 E.

A—0 to 4 inches; very dark brown (10YR 2/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common fine roots; many very fine irregular pores; about 2 percent gravel; very strongly acid; abrupt smooth boundary.
E1—4 to 15 inches; dark brown (7.5YR 4/4) sand, light brown (7.5YR 6/4) dry; weak coarse subangular blocky structure; very friable; common medium roots; many very fine irregular pores; about 2 percent gravel; very strongly acid; gradual wavy boundary.
E2—15 to 39 inches; strong brown (7.5YR 5/6) sand, reddish yellow (7.5YR 6/6) dry; weak coarse subangular blocky structure; very friable; common medium roots; few fine irregular pores; about 1 percent gravel and 2 percent cobbles; strongly acid; abrupt broken boundary.
E&Bt—39 to 60 inches; light brown (7.5YR 6/4) sand (E); single grain; loose; strongly acid; several wavy and discontinuous brown (7.5YR 4/4) lamellae of loamy sand (Bt) ⅛ to 1½ inches thick; weak medium subangular blocky structure; friable; few fine roots; about 7 percent gravel and 2 percent cobbles; medium acid.

The content of gravel ranges from 0 to 15 percent throughout the profile, and the content of cobbles ranges from 0 to 5 percent. Some pedons have scattered stones on the surface.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. The E horizon has hue of 7.5YR or 10YR and value of 4 to 6. The E&Bt horizon consists of strata of E material that range from 1 to 4 inches in thickness and lamellae of Bt material that range from ⅛ to 1½ inches in thickness. The strata of E material have hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 4 to 6. Depth to the first Bt lamella is 36 to 50 inches. The lamellae have hue of 5YR, 7.5YR, or 10YR, value of 3 to 5, and chroma of 3 to 6. They are loamy sand or sandy loam.

Fisk Series

The Fisk series consists of somewhat poorly drained soils in glacial lake basins. These soils formed in sandy deposits over loamy and silty water-laid deposits. Permeability is rapid in the sandy upper part of the profile and moderate in the loamy and silty deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Fisk loamy sand, 0 to 3 percent slopes, approximately 2,020 feet north and 2,600 feet east of the southwest corner of sec. 22, T. 18 N., R. 12 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; very friable; few fine and medium roots; medium acid; abrupt smooth boundary.
Bw1—8 to 23 inches; yellowish brown (10YR 5/6) sand; weak coarse subangular blocky structure; very friable; slightly acid; gradual wavy boundary.
Bw2—23 to 33 inches; yellowish brown (10YR 5/6) sand; many medium prominent strong brown (7.5YR 5/8) and common medium prominent light brownish gray (10YR 6/2) mottles; weak very coarse subangular blocky structure; very friable; slightly acid; abrupt wavy boundary.
2Bg1—33 to 36 inches; brown (7.5YR 5/2) fine sandy

loam; many coarse prominent strong brown (7.5YR 5/8) mottles; weak very coarse subangular blocky structure; very friable; slightly acid; clear wavy boundary.

2Bg2—36 to 41 inches; pinkish gray (7.5YR 6/2) silt loam; many coarse prominent strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; very friable; slightly acid; clear wavy boundary.

2Cg1—41 to 49 inches; pinkish gray (7.5YR 7/2) silt loam; many medium prominent strong brown (7.5YR 5/6) mottles; massive; very friable; neutral; clear wavy boundary.

2Cg2—49 to 60 inches; pinkish gray (7.5YR 7/2) silt loam; common coarse prominent strong brown (7.5YR 5/8) mottles; massive; very friable; neutral and slightly effervescent at a depth of 55 inches.

The solum ranges from 30 to 50 inches in thickness. The sandy upper part of the profile ranges from 20 to 40 inches in thickness.

The Ap horizon has value of 2 to 4 and chroma of 1 to 3. The Bw horizon has value of 4 to 6 and chroma of 4 to 8. It is loamy sand or sand. The 2Bg horizon has hue of 5YR, 7.5YR, or 10YR and value of 4 to 7. It is fine sandy loam, very fine sandy loam, or silt loam. The 2Cg horizon has colors similar to those of the 2Bg horizon. It is silt loam or stratified silt loam and very fine sandy loam.

Hortonville Series

The Hortonville series consists of well drained soils on moraines. These soils formed in loamy glacial till. Permeability is moderately slow in the subsoil and moderately slow or slow in the substratum. Slope ranges from 2 to 12 percent.

Typical pedon of Hortonville fine sandy loam, 2 to 6 percent slopes, approximately 2,620 feet south and 1,820 feet west of the northeast corner of sec. 17, T. 20 N., R. 13 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; about 2 percent gravel; slightly acid; abrupt smooth boundary.

B/E—8 to 13 inches; reddish brown (5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; few faint dark reddish brown (5YR 3/4) clay films on faces of Bt peds; brown (7.5YR 5/2) loam (E), pinkish gray (7.5YR 7/2) dry, interfingers (⅛ to ⅜ inch wide) penetrate and occupy about 25 percent of this horizon; about 2 percent gravel; medium acid; clear wavy boundary.

Bt—13 to 29 inches; reddish brown (5YR 4/4) clay loam; strong fine angular blocky structure; firm; few fine roots; many faint dark reddish brown (5YR 3/4) clay films on faces of peds; about 2 percent gravel; medium acid; clear wavy boundary.

BC—29 to 35 inches; reddish brown (5YR 4/4) loam; moderate medium subangular blocky structure; firm; about 3 percent gravel; slightly acid; clear wavy boundary.

C—35 to 60 inches; reddish brown (5YR 5/4) loam; massive; friable; about 4 percent gravel; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches. The content of gravel and cobbles ranges from 1 to 15 percent throughout the solum and substratum.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3. It is loam or fine sandy loam. The E horizon, where it occurs, has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. The Bt horizon is dominantly clay loam or silty clay loam, but in some pedons it has thin or transitional subhorizons of loam. The BC horizon has texture similar to that of the Bt horizon. The C horizon is fine sandy loam, loam, or clay loam.

Houghton Series

The Houghton series consists of very poorly drained soils on outwash plains and moraines. These soils formed in more than 51 inches of organic material. Permeability is moderately slow to moderately rapid. Slope is 0 to 1 percent.

Typical pedon of Houghton muck, 0 to 1 percent slopes, approximately 310 feet north and 30 feet east of the southwest corner of sec. 24, T. 20 N., R. 13 E.

Oa1—0 to 7 inches; sapric material, black (10YR 2/1) broken face, rubbed, and pressed; about 5 percent fiber, less than 5 percent rubbed; weak coarse subangular blocky structure; slightly sticky; many medium and fine roots; slightly acid; abrupt smooth boundary.

Oa2—7 to 15 inches; sapric material, very dark gray (10YR 3/1) broken face, black (10YR 2/1) rubbed, and very dark grayish brown (10YR 3/2) pressed; about 20 percent fiber, 7 percent rubbed; weak thick platy structure; nonsticky; common fine and medium

roots; slightly acid; clear wavy boundary.
Oa3—15 to 26 inches; sapric material, black (10YR 2/1) broken face and rubbed, very dark gray (10YR 3/1) pressed; about 5 percent fiber, 2 percent rubbed; weak medium subangular blocky structure; slightly sticky; common medium roots; slightly acid; clear wavy boundary.
Oa4—26 to 42 inches; sapric material, very dark brown (10YR 2/2) broken face and very dark gray (10YR 3/1) rubbed and pressed; about 10 percent fiber, 2 percent rubbed; weak coarse subangular blocky structure; nonsticky; few fine roots; slightly acid; gradual wavy boundary.
Oa5—42 to 60 inches; sapric material, very dark brown (10YR 2/2) broken face and pressed, very dark gray (10YR 3/1) rubbed; about 20 percent fiber, 1 percent rubbed; weak thick platy structure; nonsticky; slightly acid.

The organic material is more than 51 inches thick. It is primarily herbaceous, but in some pedons it is 5 to 10 percent woody fragments.

The sapric material is neutral or has hue of 10YR or 7.5YR and chroma of 1 to 3, broken face, rubbed, or pressed. Some pedons have thin layers of hemic material.

Keowns Series

The Keowns series consists of poorly drained, moderately permeable soils in glacial lake basins. These soils formed in silty and loamy water-laid deposits. Slope ranges from 0 to 2 percent.

These soils have a slightly thicker dark colored surface layer than is defined as the range for the Keowns series. This difference does not significantly alter the usefulness and behavior of the soils.

Typical pedon of Keowns silt loam, 0 to 2 percent slopes, approximately 1,520 feet south and 1,600 feet west of the northeast corner of sec. 15, T. 18 N., R. 12 E.

Ap—0 to 11 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; weak coarse subangular blocky structure parting to weak medium granular; friable; few fine and medium roots; neutral; abrupt smooth boundary.
A—11 to 13 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; few medium prominent red (2.5YR 4/8) mottles; weak fine subangular blocky structure; friable; mildly alkaline; abrupt wavy boundary.
Bg1—13 to 18 inches; grayish brown (10YR 5/2) silt loam; common medium prominent red (2.5YR 4/8) mottles; weak medium subangular blocky structure; friable; mildly alkaline; clear wavy boundary.
Bg2—18 to 22 inches; grayish brown (10YR 5/2) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; mildly alkaline; clear wavy boundary.
BCg—22 to 29 inches; grayish brown (10YR 5/2) very fine sandy loam; many coarse prominent yellowish red (5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; mildly alkaline; clear wavy boundary.
Cg1—29 to 38 inches; light brownish gray (10YR 6/2) silt loam; many coarse prominent yellowish red (5YR 5/8) mottles; massive; very friable; slightly effervescent; mildly alkaline; clear wavy boundary.
Cg2—38 to 55 inches; grayish brown (10YR 5/2) stratified very fine sandy loam and sandy loam; many coarse prominent yellowish brown (10YR 5/8) mottles; massive; very friable; strata 1 to 8 inches thick; slightly effervescent; mildly alkaline; clear wavy boundary.
Cg3—55 to 60 inches; light gray (10YR 7/2) silt loam; many coarse prominent dark reddish brown (5YR 3/4) mottles; massive; friable; slightly effervescent; mildly alkaline.

The thickness of the solum ranges from 20 to 32 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has hue of 2.5Y or 10YR, value of 5 to 7, and chroma of 1 or 2. It typically is very fine sandy loam or silt loam, but in some pedons it has thin subhorizons of fine sand or very fine sand. The Cg horizon has hue of 2.5Y or 10YR, value of 4 to 7, and chroma of 1 or 2. It is mainly stratified very fine sandy loam, sandy loam, and silt loam but has strata of fine sand, very fine sand, or fine sandy loam in some pedons.

Kewaunee Series

The Kewaunee series consists of well drained, moderately slowly permeable or slowly permeable soils on moraines. These soils formed in loamy and silty deposits and clayey glacial till. Slope ranges from 2 to 6 percent.

Typical pedon of Kewaunee loam, 2 to 6 percent slopes, approximately 1,100 feet south and 1,250 feet east of the northwest corner of sec. 24, T. 18 N., R. 13 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) loam, light brownish gray (10YR 6/2) dry; moderate medium

granular structure; friable; few fine and medium roots; many very fine irregular pores; about 2 percent gravel; neutral; abrupt smooth boundary.

Bt1—8 to 19 inches; reddish brown (5YR 5/4) silty clay loam; moderate coarse subangular blocky structure parting to strong very fine angular blocky; firm; few fine and medium roots; few very fine tubular and many very fine irregular pores; few clay flows in old root channels; few faint continuous reddish brown (5YR 4/4) clay films on faces of peds; about 2 percent gravel; medium acid; clear wavy boundary.

Bt2—19 to 29 inches; reddish brown (5YR 4/4) clay; strong very fine angular blocky structure; firm; few fine roots; common very fine vesicular and irregular pores; few clay flows in old root channels; about 3 percent gravel; medium acid; clear wavy boundary.

BC—29 to 32 inches; reddish brown (5YR 4/4) clay; strong very fine angular blocky structure; firm; few very fine irregular pores; few slickensides; about 3 percent gravel; neutral; clear wavy boundary.

C—32 to 60 inches; reddish brown (5YR 4/4) silty clay loam; massive; firm; about 4 percent gravel and 2 percent cobbles; many circular spots of light gray (10YR 7/2) soft lime accumulations; violently effervescent; moderately alkaline.

The thickness of the solum ranges from 24 to 36 inches. The content of gravel ranges from 0 to 10 percent in the subsoil and substratum. The content of cobbles ranges from 0 to 2 percent and is highest in the substratum.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3. The Bt horizon has value of 3 to 5 and chroma of 3 or 4. It is dominantly clay, but in the upper part it is commonly silty clay loam. The C horizon is typically silty clay loam, but in some pedons it has thin strata of clay, silty clay, or clay loam.

Kingsville Series

The Kingsville series consists of poorly drained, rapidly permeable soils on outwash plains, in glacial lake basins, and on low beach ridges. These soils formed in sandy deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Kingsville loamy sand, 0 to 2 percent slopes, approximately 1,760 feet south and 75 feet west of the northeast corner of sec. 33, T. 20 N., R. 8 E.

Ap—0 to 7 inches; black (N 2/0) loamy sand, very dark gray (N 3/0) dry; weak coarse subangular blocky structure parting to weak medium granular; very friable; common fine and medium roots; about 1 percent gravel; strongly acid; abrupt smooth boundary.

AC—7 to 15 inches; 80 percent very dark gray (10YR 3/1) sand, gray (10YR 5/1) dry, and 20 percent pale brown (10YR 6/3) sand; weak coarse subangular blocky structure; very friable; few fine roots; about 1 percent gravel; sand grains are uncoated; slightly acid; clear wavy boundary.

Cg—15 to 60 inches; 80 percent grayish brown (10YR 5/2) sand and 20 percent pale brown (10YR 6/3) sand; single grain; loose; about 5 percent gravel; sand grains are uncoated; neutral.

The content of gravel ranges from 0 to 5 percent throughout the profile. The Ap horizon is neutral or has value of 2 or 3 and chroma of 1 or 2. The AC horizon has hue of 2.5Y or 10YR, value of 3 to 6, and chroma of 1 to 3. It is sand or fine sand. The Cg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 or 3. It is typically sand, but it has thin strata of fine sand or loamy fine sand in some pedons.

Leola Series

The Leola series consists of somewhat poorly drained soils on outwash plains. These soils formed in sandy and loamy deposits. Permeability is moderately rapid in the subsoil and rapid in the substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Leola loamy sand, 0 to 2 percent slopes, approximately 660 feet south and 2,600 feet east of the northwest corner of sec. 8, T. 20 N., R. 8 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; few fine roots; medium acid; abrupt smooth boundary.

Bw1—8 to 16 inches; yellowish brown (10YR 5/4) loamy sand; few fine prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; few fine roots; medium acid; clear wavy boundary.

Bw2—16 to 24 inches; yellowish brown (10YR 5/4) loamy sand; common medium prominent strong brown (7.5YR 5/8) and few medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; very friable; about 5 percent gravel and 3 percent cobbles; medium acid; clear wavy boundary.

Bt—24 to 31 inches; 60 percent strong brown (7.5YR

5/8) loamy sand and 40 percent light brownish gray (10YR 6/2) loamy sand; weak coarse subangular blocky structure; very friable; few faint clay bridges between sand grains; about 3 percent gravel; medium acid; clear wavy boundary.

Btg1—31 to 37 inches; 60 percent light brownish gray (10YR 6/2) sandy loam and 40 percent strong brown (7.5YR 5/8) sandy loam; weak medium subangular blocky structure; friable; common faint clay bridges between sand grains; about 3 percent gravel; medium acid; clear wavy boundary.

Btg2—37 to 44 inches; light brownish gray (10YR 6/2) loamy sand; many coarse prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; few faint clay bridges between sand grains; about 3 percent gravel; strongly acid; clear wavy boundary.

Cg1—44 to 51 inches; 50 percent light brownish gray (10YR 6/2) sand and 50 percent strong brown (7.5YR 5/8) sand; single grain; loose; about 3 percent gravel; slightly acid; clear wavy boundary.

Cg2—51 to 60 inches; light brownish gray (10YR 6/2) sand; many coarse prominent strong brown (7.5YR 5/8) mottles; single grain; loose; about 3 percent gravel; neutral.

The thickness of the solum ranges from 30 to 50 inches. The content of gravel ranges from 2 to 15 percent in the solum and from 2 to 30 percent in the substratum. The content of cobbles ranges from 0 to 5 percent in the subsoil and substratum.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has value and chroma of 4 to 6. The Bt horizon has value of 4 to 6 and chroma of 2 to 8. It is sandy loam or loamy sand. The Cg horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 8.

Manawa Series

The Manawa series consists of somewhat poorly drained, slowly permeable soils on moraines and in glacial lake basins. These soils formed in silty and clayey deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Manawa silt loam, 0 to 3 percent slopes, approximately 600 feet south and 200 feet west of the northeast corner of sec. 24, T. 18 N., R. 13 E.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many fine and medium roots; common fine vesicular pores and few very fine tubular pores; neutral; abrupt smooth boundary.

Bt1—9 to 12 inches; reddish brown (5YR 4/4) clay; few fine distinct yellowish red (5YR 5/6) mottles; strong very fine angular blocky structure; firm; few fine roots; common fine vesicular pores and few very fine tubular pores; continuous faint dark reddish brown (5YR 3/4) clay films on faces of peds; few clay flows in pores; medium acid; clear wavy boundary.

Bt2—12 to 16 inches; reddish brown (5YR 4/4) clay; few fine distinct reddish gray (5YR 5/2) and many medium distinct yellowish red (5YR 5/6) mottles; strong very fine angular blocky structure; firm; few fine roots; common fine vesicular pores and few very fine tubular pores; continuous faint dark reddish brown (5YR 3/4) clay films on faces of peds; few clay flows in pores; slightly acid; clear wavy boundary.

Bt3—16 to 26 inches; reddish brown (5YR 5/4) clay; many medium distinct pinkish gray (5YR 6/2) and many coarse prominent yellowish red (5YR 5/8) mottles; moderate fine angular blocky structure; firm; common medium vesicular pores and few fine tubular pores; continuous faint reddish brown (5YR 4/4) clay films on faces of peds; few slickensides; neutral; clear wavy boundary.

BC—26 to 29 inches; reddish brown (5YR 4/4) silty clay; many medium distinct pinkish gray (5YR 6/2) mottles; moderate fine subangular blocky structure; firm; few fine tubular pores; about 5 percent dolomite gravel; slightly effervescent; neutral; clear wavy boundary.

C—29 to 60 inches; reddish brown (5YR 4/4) silty clay loam; massive; firm; about 3 percent dolomite gravel; many light gray (10YR 7/1) web-shaped soft lime accumulations; violently effervescent; moderately alkaline.

The thickness of the solum ranges from 24 to 36 inches. The content of gravel ranges from 0 to 12 percent in the subsoil and substratum.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. The Bt horizon has chroma of 3 or 4. It is commonly clay or silty clay, but some pedons have thin subhorizons of silty clay loam or clay loam. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is typically silty clay loam, but in some pedons it has thin strata of silty clay or clay loam.

Mecosta Series

The Mecosta series consists of somewhat

excessively drained, rapidly permeable soils on moraines. These soils formed in sandy and gravelly deposits. Slope ranges from 12 to 20 percent.

Typical pedon of Mecosta gravelly loamy sand, in an area of Boyer-Mecosta complex, 12 to 20 percent slopes, approximately 2,590 feet west and 2,440 feet south of the northeast corner of sec. 9, T. 19 N., R. 10 E.

A—0 to 8 inches; very dark gray (10YR 3/1) gravelly loamy sand, dark grayish brown (10YR 4/2) dry; weak medium granular structure; very friable; common fine roots; about 20 percent gravel and 10 percent cobbles; neutral; abrupt wavy boundary.

Bw—8 to 15 inches; brown (7.5YR 4/4) gravelly loamy sand; weak coarse subangular blocky structure; very friable; common fine roots; about 20 percent gravel and 10 percent cobbles; mildly alkaline; abrupt wavy boundary.

C—15 to 60 inches; pale brown (10YR 6/3) very gravelly sand; single grain; loose; about 50 percent gravel and 15 percent cobbles; slightly effervescent; mildly alkaline.

The thickness of the solum ranges from 8 to 17 inches. The content of gravel ranges from 10 to 25 percent in the solum and from 35 to 70 percent in the substratum. The content of cobbles ranges from 5 to 10 percent in the solum and from 5 to 15 percent in the substratum.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is loamy sand or gravelly loamy sand. The C horizon has value of 5 or 6 and chroma of 3 or 4.

Meehan Series

The Meehan series consists of somewhat poorly drained, rapidly permeable soils on outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Meehan loamy sand, 0 to 3 percent slopes, approximately 2,600 feet south and 100 feet east of the northwest corner of sec. 34, T. 20 N., R. 8 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; many fine and medium roots; few fine tubular pores; strongly acid; abrupt smooth boundary.

Bw1—8 to 15 inches; yellowish brown (10YR 5/4) sand; common medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very friable; few fine roots; about 5 percent gravel; strongly acid; clear wavy boundary.

Bw2—15 to 22 inches; pale brown (10YR 6/3) sand; few fine prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; sand grains are uncoated; strongly acid; clear wavy boundary.

Bw3—22 to 33 inches; pale brown (10YR 6/3) sand; many coarse prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; about 1 percent gravel; sand grains are uncoated; medium acid; clear wavy boundary.

C—33 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; about 1 percent gravel; sand grains are uncoated; medium acid.

The thickness of the solum ranges from 24 to 42 inches. The content of gravel ranges from 0 to 15 percent in the subsoil and substratum.

The 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 value of 5 to 7 and chroma of 2 to 4.

Morocco Series

The Morocco series consists of somewhat poorly drained, rapidly permeable soils in glacial lake basins. These soils formed in sandy deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Morocco fine sand, 0 to 3 percent slopes, approximately 100 feet south and 880 feet west of the northeast corner of sec. 26, T. 18 N., R. 12 E.

Ap—0 to 8 inches; very dark gray (10YR 3/1) fine sand, gray (10YR 5/1) dry; weak medium granular structure; very friable; common fine roots; medium acid; abrupt smooth boundary.

Bw1—8 to 11 inches; yellowish brown (10YR 5/4) fine sand; weak coarse subangular blocky structure; very friable; medium acid; clear wavy boundary.

Bw2—11 to 25 inches; yellowish brown (10YR 5/6) fine sand; few medium prominent grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; very friable; strongly acid; clear wavy boundary.

C1—25 to 33 inches; yellowish brown (10YR 5/8) fine sand; many coarse prominent light brownish gray (10YR 6/2) mottles; single grain; loose; medium acid; clear wavy boundary.

C2—33 to 60 inches; pale brown (10YR 6/3) fine sand;

many coarse prominent yellowish brown (10YR 5/8) mottles; single grain; loose; medium acid; clear wavy boundary.

The thickness of the solum ranges from 24 to 42 inches. These soils are typically free of coarse fragments, but some pedons contain as much as 12 percent gravel in the subsoil and substratum.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. The C horizon has chroma of 2 to 8. It is dominantly fine sand, but in some pedons it has thin, discontinuous strata of sand.

Nebago Series

The Nebago series consists of somewhat poorly drained soils in glacial lake basins. These soils formed in sandy, loamy, and clayey deposits. Permeability is rapid in the sandy part of the subsoil and moderately slow or slow in the clayey part of the subsoil and in the substratum. Slope ranges from 0 to 3 percent.

Typical pedon of Nebago loamy fine sand, 0 to 3 percent slopes, approximately 500 feet west and 200 feet north of the southeast corner of sec. 16, T. 18 N., R. 13 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; very friable; many medium and few very fine roots; slightly acid; abrupt smooth boundary.

Bw1—9 to 17 inches; brown (10YR 4/3) fine sand; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very friable; few very fine roots; slightly acid; clear wavy boundary.

Bw2—17 to 22 inches; brown (10YR 4/3) fine sand; few fine faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very friable; few very fine roots; slightly acid; abrupt smooth boundary.

Bw3—22 to 24 inches; brown (7.5YR 5/4) fine sandy loam; common medium prominent grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; thin strata of loamy fine sand make up about 40 percent of this horizon; slightly acid; abrupt smooth boundary.

2Bw4—24 to 31 inches; reddish brown (5YR 4/4) clay; common coarse prominent strong brown (7.5YR 5/6) mottles; moderate fine angular blocky structure; firm; slightly acid; clear wavy boundary.

2BC—31 to 42 inches; reddish brown (5YR 4/4) clay; few medium prominent strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; firm; slightly acid; clear wavy boundary.

2C—42 to 60 inches; reddish brown (5YR 4/4) clay; massive; firm; slightly effervescent in few fine gray (5Y 5/1) carbonate accumulations; neutral.

The thickness of the solum ranges from 30 to 50 inches. The sandy upper part of the profile ranges from 20 to 40 inches in thickness. These soils are typically free of coarse fragments, but some pedons have as much as 10 percent gravel in the clayey part of the subsoil and in the substratum.

The Ap horizon has value of 2 to 4 and chroma of 1 to 3. The Bw horizon has value of 4 to 6 and chroma of 3 to 6. It is fine sand or loamy fine sand. The 2Bw horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 2 to 4. It is typically clay or silty clay, but thin subhorizons at the sand-clay contact are sandy loam or loam. The 2C horizon has hue of 7.5YR or 5YR and value and chroma of 3 to 5. It is typically clay or silty clay, but in some pedons it has thin strata of silt, silty clay loam, silt loam, or fine sand.

Okee Series

The Okee series consists of somewhat excessively drained, moderately permeable or moderately rapidly permeable soils on moraines. These soils formed in sandy and loamy glacial till. Slope ranges from 2 to 20 percent.

Typical pedon of Okee loamy sand, 6 to 12 percent slopes, approximately 20 feet south and 2,500 feet east of the northwest corner of sec. 25, T. 20 N., R. 8 E.

A—0 to 2 inches; black (10YR 2/1) loamy sand, very dark brown (10YR 2/2) dry; weak fine granular structure; very friable; few fine, medium, and coarse roots; few fine tubular pores; about 5 percent gravel; neutral; abrupt smooth boundary.

Bw1—2 to 6 inches; dark yellowish brown (10YR 4/4) loamy sand, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; very friable; few fine, medium, and coarse roots; about 5 percent gravel and 5 percent cobbles; medium acid; clear wavy boundary.

Bw2—6 to 23 inches; yellowish brown (10YR 5/4) sand, very pale brown (10YR 7/4) dry; weak coarse subangular blocky structure; very friable; few fine, medium, and coarse roots; about 5 percent gravel

and 5 percent cobbles; slightly acid; abrupt wavy boundary.

2Bt1—23 to 35 inches; brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine, medium, and coarse roots; common faint reddish brown (5YR 4/4) clay films on faces of peds; about 10 percent gravel and 5 percent cobbles; slightly acid; gradual wavy boundary.

2Bt2—35 to 42 inches; brown (7.5YR 4/4) loamy sand; weak coarse subangular blocky structure; very friable; common faint clay bridges between sand grains; about 7 percent gravel and 5 percent cobbles; slightly acid; gradual wavy boundary.

2BC—42 to 60 inches; brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; about 8 percent gravel, 7 percent cobbles, and 3 percent boulders; neutral.

The thickness of the solum ranges from 50 to more than 60 inches. The thickness of the sandy upper horizons ranges from 20 to 40 inches. The content of gravel and cobbles ranges from 5 to 12 percent in the upper part of the subsoil and from 5 to 35 percent in the lower part.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has value of 4 to 6 and chroma of 3 to 5. It is sand or loamy sand. The 2Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is typically sandy loam in the upper part and loamy sand in the lower part, but in some pedons it has thin subhorizons of sandy clay loam. The 2BC horizon has colors similar to those of the 2Bt horizon. It is loamy sand or sand or the gravelly or cobbly analogs of those textures. The C horizon, where it occurs above a depth of 60 inches, has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It has textures similar to those of the 2BC horizon.

Palms Series

The Palms series consists of very poorly drained soils in glacial lake basins. These soils formed in muck 16 to 51 inches of deep over silty or loamy deposits. Permeability is moderately rapid to moderately slow in the muck layer and moderate or moderately slow in the substratum. Slope is 0 to 1 percent.

Typical pedon of Palms muck, 0 to 1 percent slopes, approximately 1,340 feet north and 660 feet west of the southeast corner of sec. 4, T. 18 N., R. 12 E.

Oa1—0 to 13 inches; sapric material, black (10YR 2/1) rubbed, broken face, and pressed; about 40 percent fiber, 10 percent rubbed; weak medium subangular blocky structure; slightly sticky; many fine and medium roots; neutral; clear wavy boundary.

Oa2—13 to 26 inches; sapric material, black (N 2/0) broken face, and black (10YR 2/1) rubbed and pressed; about 20 percent fiber, less than 5 percent rubbed; weak medium subangular blocky structure; slightly sticky; few fine roots; slightly acid; abrupt wavy boundary.

C—26 to 60 inches; gray (10YR 5/1) silt loam; massive; sticky; neutral.

Depth to the silty or loamy substratum ranges from 16 to 51 inches. The organic material is primarily herbaceous, but some layers are as much as 10 percent woody fragments.

The surface tier is neutral or has hue of 7.5YR or 10YR and chroma of 1 or 2. The subsurface and bottom tiers are neutral or have hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have layers of hemic material less than 10 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 3 to 7, and chroma of 1 or 2. It is fine sandy loam, loam, silt loam, clay loam, or silty clay loam. In many pedons it has thin strata of loamy sand.

Pearl Series

The Pearl series consists of moderately well drained soils on outwash plains and stream terraces. These soils formed in sandy and loamy outwash. Permeability is moderately rapid in the subsoil and rapid in the substratum. Slope ranges from 0 to 3 percent.

Typical pedon of Pearl loamy sand, 0 to 3 percent slopes, approximately 200 feet south and 100 feet east of the northwest corner of sec. 4, T. 20 N., R. 8 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak coarse granular structure; very friable; many fine roots; many fine vesicular pores; neutral; abrupt smooth boundary.

E1—8 to 20 inches; brown (7.5YR 5/4) sand; weak coarse subangular blocky structure; very friable; few fine roots; about 2 percent gravel; medium acid; gradual wavy boundary.

E2—20 to 36 inches; brown (7.5YR 5/4) sand; common medium prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; few fine roots; about 2 percent gravel; slightly acid; abrupt wavy boundary.

Bt1—36 to 40 inches; dark brown (7.5YR 4/4) sandy

loam; common medium prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; very friable; common fine irregular pores; common faint clay films on faces of peds; about 2 percent gravel; strongly acid; clear wavy boundary.

Bt2—40 to 44 inches; dark brown (7.5YR 4/4) loamy sand; common medium prominent strong brown (7.5YR 5/8) and common medium prominent light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; very friable; common fine irregular pores; common faint clay bridges between sand grains; about 2 percent gravel; medium acid; abrupt wavy boundary.

C—44 to 60 inches; light brownish gray (10YR 6/2) sand; common coarse prominent strong brown (7.5YR 5/8) mottles; single grain; loose; about 1 percent gravel; neutral.

The solum ranges from 30 to 50 inches in thickness. The content of gravel ranges from 0 to 15 percent in the solum and from 0 to 30 percent in the substratum. The content of cobbles ranges from 0 to 5 percent in the subsoil and substratum.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have a thin layer, below the A or Ap horizon, that has the color of a spodic horizon but does not meet the chemical requirements. The E horizon has value of 5 or 6 and chroma of 3 or 4. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6.

Plainfield Series

The Plainfield series consists of excessively drained and moderately well drained soils on outwash plains, stream terraces, and moraines. These soils formed in sand. Permeability is rapid. Slope ranges from 0 to 30 percent.

Typical pedon of Plainfield sand, 0 to 2 percent slopes, approximately 2,180 feet north and 1,020 feet west of the southeast corner of sec. 16, T. 19 N., R. 8 E.

Ap—0 to 7 inches; dark brown (10YR 3/3) sand, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; few fine roots; neutral; abrupt smooth boundary.

Bw1—7 to 16 inches; brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; few fine roots; about 6 percent gravel; a stratum at a depth of 14 to 16 inches contains about 25 percent gravel; slightly acid; abrupt smooth boundary.

Bw2—16 to 28 inches; strong brown (7.5YR 5/6) sand; weak coarse subangular blocky structure; very friable; few fine roots; about 6 percent gravel; a stratum at a depth of 25 to 28 inches contains about 30 percent gravel; medium acid; clear wavy boundary.

BC—28 to 36 inches; brown (7.5YR 5/4) sand; single grain; loose; about 3 percent gravel; medium acid; clear wavy boundary.

C—36 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 2 percent gravel; medium acid.

The thickness of the solum ranges from 18 to 48 inches. The content of gravel ranges from 0 to 15 percent in the solum and substratum, but thin subhorizons contain as much as 35 percent gravel.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. The Bw and BC horizons have hue of 10YR or 7.5YR. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 4 to 8. The loamy substratum phase is very fine sandy loam, loam, or silt loam below a depth of 40 inches. These loamy deposits have hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 4 to 6. The wet substratum phase has mottles below a depth of 40 inches.

Poy Series

The Poy series consists of poorly drained soils in glacial lake basins. These soils formed in clayey water-laid deposits over sand. Permeability is slow in the subsoil and rapid in the substratum. Slope ranges from 0 to 2 percent.

Typical pedon of Poy clay, 0 to 2 percent slopes, approximately 700 feet south and 900 feet east of the northwest corner of sec. 21, T. 19 N., R. 13 E.

Ap—0 to 9 inches; black (N 2/0) clay, dark gray (N 4/0) dry; moderate medium granular structure; firm; few fine roots; few fine vesicular pores and few very fine tubular pores; neutral; abrupt smooth boundary.

A—9 to 12 inches; black (N 2/0) clay, dark gray (N 4/0) dry; weak coarse subangular blocky structure parting to moderate medium granular; firm; few fine roots; few fine vesicular pores; neutral; abrupt wavy boundary.

Bg1—12 to 15 inches; gray (5Y 5/1) clay; many medium prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; firm; few fine vesicular pores and few very fine tubular pores; neutral; clear wavy boundary.

Bg2—15 to 19 inches; grayish brown (10YR 5/2) clay;

many coarse prominent strong brown (7.5YR 5/8) mottles; weak very fine angular blocky structure; firm; few fine vesicular pores and few very fine tubular pores; neutral; clear wavy boundary.

BC—19 to 29 inches; reddish brown (5YR 4/4) clay; common coarse prominent strong brown (7.5YR 5/8) and common medium prominent light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; few fine vesicular pores and common very fine tubular pores; neutral; clear wavy boundary.

2C1—29 to 49 inches; pale brown (10YR 6/3) sand; single grain; loose; slightly effervescent; mildly alkaline; clear wavy boundary.

2C2—49 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; slightly effervescent; mildly alkaline.

The thickness of the solum ranges from 20 to 36 inches. The 2C horizon typically does not have coarse fragments, but in some pedons the content of gravel in this horizon is as much as 10 percent.

The Ap or A horizon is neutral or has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Bg horizon has hue of 2.5Y, 5Y, or 10YR and value of 4 or 5. It is clay, silty clay, or silty clay loam. The BC horizon has hue of 5YR, 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is clay or silty clay. The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is sand or fine sand.

Poygan Series

The Poygan series consists of poorly drained, slowly permeable soils in glacial lake basins and on moraines. These soils formed in silty and clayey deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Poygan silty clay loam, 0 to 2 percent slopes, approximately 300 feet north and 500 feet west of the southeast corner of sec. 36, T. 18 N., R. 13 E.

Ap—0 to 11 inches; black (N 2/0) silty clay loam, dark gray (N 4/0) dry; moderate fine granular structure; friable; few fine and medium roots; few fine vesicular pores and few very fine tubular pores; neutral; abrupt smooth boundary.

Bg1—11 to 14 inches; gray (10YR 5/1) silty clay; common medium prominent brown (7.5YR 4/4) mottles; moderate very fine subangular blocky structure; firm; few fine and medium roots; few fine vesicular pores and few very fine tubular pores; mildly alkaline; clear wavy boundary.

Bg2—14 to 16 inches; gray (10YR 5/1) clay; many coarse prominent brown (7.5YR 5/4) mottles; moderate very fine angular blocky structure; firm; few fine roots; few fine vesicular pores and few very fine tubular pores; mildly alkaline; clear wavy boundary.

Bg3—16 to 26 inches; grayish brown (10YR 5/2) clay; many coarse prominent brown (7.5YR 5/4) mottles; moderate very fine subangular blocky structure; firm; few fine roots; few fine vesicular pores and few very fine tubular pores; mildly alkaline; clear wavy boundary.

BCg—26 to 32 inches; grayish brown (10YR 5/2) clay; common medium prominent brown (7.5YR 5/4) mottles; moderate coarse subangular blocky structure; firm; few fine roots; few fine vesicular pores and few very fine tubular pores; mildly alkaline; clear wavy boundary.

C—32 to 60 inches; reddish brown (5YR 5/4) clay; many coarse distinct reddish gray (5YR 5/2) mottles; massive; firm; common large streaks of light gray (10YR 7/2) soft lime accumulations; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 24 to 36 inches. The content of gravel ranges from 0 to 10 percent in the subsoil and substratum.

The Ap horizon is neutral or has hue of 10YR and value of 2 or 3. The Bg horizon has hue of 10YR or 2.5Y and value of 4 or 5. It is typically clay or silty clay, but in some pedons it has thin subhorizons of silty clay loam. The BCg horizon has colors and textures similar to those of the Bg horizon. The C horizon has hue of 5YR, 7.5YR, or 2.5YR, value of 4 to 6, and chroma of 3 or 4. It is typically silty clay or clay, but in some pedons it is clay loam or silty clay loam.

Richford Series

The Richford series consists of somewhat excessively drained soils on outwash plains and stream terraces. These soils formed in loamy and sandy outwash deposits. Permeability is moderately rapid and rapid in the upper part of the profile and rapid in the lower part. Slope ranges from 0 to 20 percent.

Typical pedon of Richford loamy sand, 0 to 2 percent slopes, approximately 50 feet north and 700 feet west of the southeast corner of sec. 9, T. 20 N., R. 8 E.

Ap—0 to 8 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; many fine and very fine irregular pores; about 3 percent gravel; neutral; abrupt smooth boundary.

EB—8 to 26 inches; dark yellowish brown (10YR 4/4) sand, light yellowish brown (10YR 6/4) dry; weak coarse subangular blocky structure; very friable; about 3 percent gravel; a stratum between depths of 18 and 24 inches contains about 25 percent cobbles; neutral; abrupt wavy boundary.

Bt1—26 to 33 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; many fine and very fine irregular pores; few faint clay films on vertical faces of peds; about 3 percent gravel; slightly acid; clear wavy boundary.

Bt2—33 to 39 inches; dark brown (7.5YR 4/4) loamy sand; weak coarse subangular blocky structure; very friable; common fine and many very fine irregular pores; many faint clay bridges between sand grains; about 3 percent gravel; neutral; clear wavy boundary.

Bt3—39 to 49 inches; dark brown (7.5YR 4/4) loamy sand; weak very coarse subangular blocky structure; very friable; few faint clay bridges between sand grains; about 3 percent gravel; neutral; clear wavy boundary.

C—49 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 3 percent gravel; neutral.

The thickness of the solum ranges from 32 to 49 inches. The content of gravel ranges from 0 to 15 percent in the subsoil and from 0 to 30 percent in the substratum. The content of cobbles ranges from 0 to 5 percent in the solum and substratum.

The Ap horizon has value and chroma of 2 or 3. The EB horizon has value of 4 to 6. It is sand or loamy sand. 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, value of 5 or 6, and chroma of 3 to 6. It is sand or gravelly sand.

Salter Series

The Salter series consists of moderately well drained, moderately permeable soils in glacial lake basins. These soils formed in loamy water-laid deposits. Slope ranges from 2 to 6 percent.

Typical pedon of Salter very fine sandy loam, 2 to 6 percent slopes, approximately 2,600 feet north and 2,600 feet west of the southeast corner of sec. 22, T. 20 N., R. 13 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; common fine roots; many very fine irregular pores; slightly acid; abrupt smooth boundary.

BA—7 to 13 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; very friable; common fine roots; many very fine irregular pores; medium acid; clear wavy boundary.

Bw—13 to 24 inches; brown (7.5YR 4/4) loam; weak medium subangular blocky structure; very friable; few fine roots; many fine vesicular pores and few fine tubular pores; strongly acid; clear wavy boundary.

BC—24 to 36 inches; brown (7.5YR 4/4) fine sandy loam; weak coarse subangular blocky structure; very friable; few fine roots; common very fine irregular pores; strongly acid; clear wavy boundary.

C1—36 to 42 inches; brown (7.5YR 4/4) silt loam; massive; very friable; few fine roots; strongly acid; clear wavy boundary.

C2—42 to 60 inches; brown (7.5YR 4/4) stratified very fine sandy loam and silt loam; few medium prominent strong brown (7.5YR 5/8) mottles in strata of silt loam that are 6 to 12 inches thick; massive; very friable; few fine roots; strongly acid.

The solum ranges from 24 to 42 inches in thickness. The Ap horizon has value of 2 to 4 and chroma of 1 or 2. The Bw horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is very fine sandy loam, loam, or silt loam. The C horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6.

Sparta Series

The Sparta series consists of excessively drained, rapidly permeable soils on outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Sparta loamy sand, 0 to 2 percent slopes, approximately 100 feet south and 1,340 feet west of the northeast corner of sec. 18, T. 18 N., R. 8 E.

Ap—0 to 12 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; common fine roots; many fine and very fine irregular pores; neutral; abrupt smooth boundary.

AB—12 to 18 inches; very dark grayish brown (10YR 3/2) loamy sand, brown (10YR 5/3) dry; weak

medium subangular blocky structure; very friable; neutral; clear wavy boundary.
Bw—18 to 27 inches; dark yellowish brown (10YR 4/4) sand; weak coarse subangular blocky structure; very friable; about 4 percent gravel; neutral; clear wavy boundary.
C1—27 to 45 inches; dark yellowish brown (10YR 4/6) sand; single grain; loose; about 5 percent gravel; slightly acid; clear wavy boundary.
C2—45 to 60 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 5 percent gravel; neutral.

The solum ranges from 24 to 40 inches in thickness. The content of gravel ranges from 0 to 10 percent throughout the solum and substratum.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The AB horizon has hue of 10YR or 7.5YR and chroma of 2 or 3. It is loamy sand or sand. The Bw horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is typically sand, but in some pedons it has thin subhorizons of loamy sand. The C horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6.

Symco Series

The Symco series consists of somewhat poorly drained, moderately slowly permeable soils on moraines. These soils formed in dominantly loamy glacial till. Slope ranges from 0 to 3 percent.

Typical pedon of Symco silt loam, 0 to 3 percent slopes, approximately 75 feet south and 1,250 feet east of the northwest corner of sec. 6, T. 19 N., R. 13 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.
Bt1—8 to 13 inches; brown (7.5YR 4/4) clay loam; many medium distinct strong brown (7.5YR 5/6) and common fine prominent dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; firm; many faint reddish brown (5YR 4/4) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.
Bt2—13 to 22 inches; reddish brown (5YR 4/4) clay loam; many medium prominent strong brown (7.5YR 5/6) and common fine prominent dark grayish brown (10YR 4/2) mottles; moderate fine angular blocky structure; firm; many faint reddish brown (5YR 4/3) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.
BC—22 to 28 inches; reddish brown (5YR 4/4) clay loam; many medium prominent strong brown (7.5YR 5/6) and dark brown (7.5YR 4/2) mottles; moderate fine subangular blocky structure; firm; about 2 percent gravel; neutral; clear wavy boundary.
C—28 to 60 inches; reddish brown (5YR 4/4) loam; many medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; common fine light gray (10YR 7/2) accumulations of free carbonates; about 3 percent gravel and 2 percent cobbles; violently effervescent; moderately alkaline.

The thickness of the solum ranges from 24 to 32 inches. The content of gravel ranges from 0 to 10 percent in the solum and substratum, and the content of cobbles ranges from 0 to 10 percent.

The Ap horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is silt loam or loamy fine sand. The Bt horizon has value of 4 to 6 and chroma of 3 or 4. It is clay loam, loam, or silty clay loam. The C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam or clay loam.

Tustin Series

The Tustin series consists of well drained soils in glacial lake basins and on moraines. These soils formed in sandy, loamy, and clayey deposits. Permeability is rapid in the upper part of the subsoil and slow in the lower part of the subsoil and in the substratum. Slope ranges from 2 to 6 percent.

Typical pedon of Tustin loamy sand, 2 to 6 percent slopes, approximately 700 feet south and 900 feet east of the northwest corner of sec. 24, T. 18 N., R. 13 E.

Ap—0 to 9 inches; brown (10YR 4/3) loamy sand, very pale brown (10YR 7/3) dry; weak medium granular structure; very friable; few fine and medium roots; slightly acid; abrupt smooth boundary.
Bw—9 to 26 inches; brown (7.5YR 5/4) sand; weak coarse subangular blocky structure; very friable; few fine and medium roots; slightly acid; clear wavy boundary.
2Bt1—26 to 30 inches; yellowish red (5YR 4/6) sandy clay loam; moderate very fine angular blocky structure; firm; few fine roots; many faint reddish brown (5YR 4/4) clay films on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.
2Bt2—30 to 37 inches; reddish brown (5YR 4/4) clay; strong very fine angular blocky structure; firm; few fine roots; few faint reddish brown (5YR 4/3) clay flows in old root channels; about 1 percent gravel; slightly acid; clear wavy boundary.

2BC—37 to 41 inches; reddish brown (5YR 4/4) clay; moderate fine angular blocky structure; firm; about 4 percent gravel; neutral; clear wavy boundary.
2C—41 to 60 inches; reddish brown (5YR 5/4) silty clay; massive; firm; common streaks of light gray (10YR 7/1) soft lime accumulations; about 3 percent gravel; violently effervescent; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches. The thickness of the sandy upper part of the profile ranges from 20 to 36 inches. The content of gravel in the clayey lower part ranges from 0 to 5 percent.

The Ap horizon has value of 2 to 4 and chroma of 2 or 3. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is sand or loamy sand. The 2Bt1 horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam, loam, or sandy clay loam. The 2Bt2 horizon has value of 3 to 5 and chroma of 3 or 4. It is typically clay or silty clay, but in some pedons it has a thin subhorizon of silty clay loam. The 2C horizon has value and chroma of 3 to 6. It typically is clay or silty clay, but in some pedons it has thin subhorizons of silty clay loam or clay loam.

Willette Series

The Willette series consists of very poorly drained soils in glacial lake basins. These soils formed in muck 16 to 51 inches of deep over clay. Permeability is moderately rapid to moderately slow in the muck layer and slow in the substratum. Slope is 0 to 1 percent.

Typical pedon of Willette muck, 0 to 1 percent slopes, approximately 1,020 feet south and 1,650 feet east of the northwest corner of sec. 15, T. 18 N., R. 13 E.

Oap—0 to 12 inches; sapric material, black (N 2/0) broken face, black (10YR 2/1) rubbed and pressed; about 15 percent fiber unrubbed, less than 5 percent rubbed; weak medium granular structure; slightly sticky; neutral; abrupt smooth boundary.
Oa1—12 to 31 inches; sapric material, black (N 2/0) broken face, black (10YR 2/1) rubbed and pressed; about 20 percent fiber, 2 percent rubbed; weak medium subangular blocky structure; slightly sticky; slightly acid; abrupt wavy boundary.
C1—31 to 38 inches; gray (5Y 5/1) clay; few medium prominent light olive brown (2.5Y 5/4) mottles; fine strata breaking to thin platy soil fragments; sticky; slightly effervescent; mildly alkaline; clear wavy boundary.
C2—38 to 60 inches; brown (7.5YR 5/2) clay; few medium prominent yellowish brown (10YR 5/6) mottles; fine strata breaking to thin platy soil fragments; sticky; strongly effervescent; moderately alkaline.

Depth to the clayey substratum ranges from 16 to 51 inches. The organic material is primarily herbaceous, but some layers contain as much as 10 percent woody fragments.

The surface tier is neutral or has hue of 10YR. The subsurface tier and bottom tier are neutral or have hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 to 3. The C horizon has hue of 5Y, 2.5Y, 10YR, 7.5YR, or 5YR and value of 4 to 6. It is typically clay or silty clay, but in some pedons it has very thin strata of silt, silt loam, or fine sand.

Yahara Series

The Yahara series consists of somewhat poorly drained, moderately permeable soils in glacial lake basins. These soils formed in loamy and silty water-laid deposits. Slope ranges from 0 to 3 percent.

These soils have a slightly thinner dark colored surface layer and contain less fine sand and coarser sand than is defined as the range for the Yahara series. These differences do not significantly alter the usefulness and behavior of the soils.

Typical pedon of Yahara very fine sandy loam, 0 to 3 percent slopes, approximately 1,920 feet south and 1,400 feet west of the northeast corner of sec. 15, T. 18 N., R. 12 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure parting to moderate fine granular; friable; few fine roots; neutral; abrupt smooth boundary.
Bw1—8 to 15 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light brownish gray (10YR 6/2) and common fine prominent yellowish brown (10YR 5/8) mottles; weak thick platy structure parting to weak fine subangular blocky; friable; few fine roots; some material from the Ap horizon is mixed into this horizon; neutral; clear wavy boundary.
Bw2—15 to 25 inches; brown (10YR 5/3) silt loam; many fine faint light brownish gray (10YR 6/2) and many fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very friable; neutral; clear wavy boundary.

BC—25 to 32 inches; brown (7.5YR 5/4) silt loam; many medium prominent light brownish gray (10YR 6/2) and many medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; neutral; clear wavy boundary.

C—32 to 60 inches; strata of light brownish gray (10YR 6/2) silt (4 to 10 inches thick) and brown (7.5YR 4/4) silt loam (1 to 3 inches thick); many medium distinct yellowish brown (10YR 5/4) mottles; massive; friable; strongly effervescent; moderately alkaline.

The thickness of the solum ranges from 24 to 36 inches. The Ap horizon has value of 2 or 3 and chroma of 1 to 3. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is dominantly silt loam, loam, or very fine sandy loam, but in some pedons it has thin strata of fine sand. The C horizon has value of 4 to 7 and chroma of 2 to 6. It typically has strata of silt, silt loam, loam, very fine sandy loam, or very fine sand.

Zittau Series

The Zittau series consists of somewhat poorly drained soils in glacial lake basins. These soils formed in clayey water-laid deposits over sandy deposits. Permeability is slow in the subsoil and upper part of the substratum and rapid in the lower part. Slope ranges from 0 to 3 percent.

These soils have carbonates at a shallower depth and have a thicker dark colored surface layer than is defined as the range for the Zittau series. These differences do not significantly alter the usefulness and behavior of the soils.

Typical pedon of Zittau clay, 0 to 3 percent slopes, approximately 2,320 feet east and 1,670 feet north of the southwest corner of sec. 34, T. 19 N., R. 13 E.

Ap—0 to 9 inches; dark brown (7.5YR 3/2) clay, grayish brown (10YR 5/2) dry; moderate very fine angular blocky structure; firm; few fine roots; few very fine tubular pores; slightly acid; abrupt smooth boundary.

Bt—9 to 13 inches; reddish brown (5YR 5/4) clay; few fine prominent gray (5Y 5/1) mottles; moderate very fine subangular blocky structure; firm; few fine roots; few very fine tubular pores; few faint reddish brown (5YR 4/4) clay films on faces of peds; neutral; clear wavy boundary.

BC—13 to 16 inches; reddish brown (5YR 5/4) clay; common fine prominent gray (5Y 5/1) mottles; moderate very fine angular blocky structure; firm; few fine roots; few very fine tubular pores; few faint reddish brown (5YR 4/4) clay films on faces of peds; slightly effervescent; mildly alkaline; clear wavy boundary.

C1—16 to 23 inches; reddish brown (5YR 5/4) clay; many fine prominent gray (5Y 5/1) mottles; strong fine angular blocky structure; firm; few fine roots; few very fine tubular pores; many large prominent light gray (10YR 7/1) carbonate accumulations; violently effervescent; moderately alkaline; clear wavy boundary.

2C2—23 to 27 inches; brown (7.5YR 4/4) loamy sand; common medium prominent light gray (N 7/0) mottles; massive; very friable; thin strata of brown (7.5YR 5/2) sandy loam; neutral; abrupt wavy boundary.

2C3—27 to 60 inches; light brown (7.5YR 6/4) sand; common medium prominent yellowish brown (10YR 5/8) and common fine prominent light brownish gray (10YR 6/2) mottles; single grain; loose; neutral.

The thickness of the solum ranges from 12 to 24 inches. The substratum typically does not contain coarse fragments. In some pedons, however, the content of gravel is as much as 10 percent.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 to 3. 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. It is clay. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay or clay. The BC horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 2 to 4. It is silty clay or clay. The 2C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 2 to 6. It is typically sand or loamy sand, but in some pedons it has thin strata of sandy loam in the upper part.

Zittau Variant

The Zittau Variant consists of somewhat poorly drained soils in glacial lake basins. These soils formed in clayey deposits over silty deposits. Permeability is slow in the subsoil and moderate in the substratum. Slope ranges from 0 to 3 percent.

Typical pedon of Zittau Variant clay, 0 to 3 percent slopes, approximately 2,000 feet south and 50 feet west of the northeast corner of sec. 3, T. 18 N., R. 12 E.

Ap—0 to 8 inches; dark brown (7.5YR 3/2) clay, brown (7.5YR 5/2) dry; moderate very fine angular blocky structure; firm; few fine roots; slightly acid; abrupt smooth boundary.

Bt1—8 to 14 inches; reddish brown (5YR 4/4) clay; moderate very fine angular blocky structure; firm; few fine roots; few faint reddish brown (5YR 4/3) clay films on faces of peds; few clay flows in root channels; neutral; clear wavy boundary.

Bt2—14 to 20 inches; reddish brown (5YR 4/4) clay; common fine prominent gray (10YR 5/1) mottles; moderate very fine angular blocky structure; firm; few faint reddish brown (5YR 4/3) clay films on faces of peds; few clay flows in root channels; neutral; abrupt wavy boundary.

BC—20 to 22 inches; brown (7.5YR 5/4) clay loam; many coarse prominent gray (10YR 5/1) mottles; weak medium subangular blocky structure; friable; neutral; abrupt wavy boundary.

2C1—22 to 50 inches; light brownish gray (10YR 6/2) silt loam; many coarse prominent yellowish brown (10YR 5/6) mottles; massive; friable; slightly effervescent; mildly alkaline; clear wavy boundary.

2C2—50 to 60 inches; light brownish gray (10YR 6/2) silt loam; many coarse prominent yellowish brown (10YR 5/6) mottles; massive; friable; common reddish brown (5YR 4/4) silty clay strata ⅛ to 1 inch thick; violently effervescent; moderately alkaline.

The thickness of the solum ranges from 18 to 30 inches. The thickness of the clayey upper part of the profile ranges from 18 to 36 inches.

The Ap horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The Bt horizon has value of 4 or 5. It is clay or silty clay. The BC horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is commonly clay loam but in some pedons is silt loam. The 2C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 6. It is commonly silt loam, but thin strata of silty clay, loam, or very fine sandy loam are in some pedons.

Formation of the Soils

This section describes the factors of soil formation and relates the processes of soil formation and horizon differentiation to the soils in the county.

Factors of Soil Formation

Soil is formed by the interaction of chemical, physical, and biological processes on the material deposited by geologic agents over a period of time. The characteristics of the soil at any given point in time are determined by: (1) the physical and mineralogical composition of the parent material; (2) the climate that has existed since the parent material accumulated; (3) the plant and animal life in and on the soil; (4) the relief; and (5) the length of time that the processes of soil development have acted on the soil material.

Active factors of soil formation are climate and plant and animal life. They act on parent material and slowly change it into a natural body, or soil, having genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of soil that can form. Finally, time is needed to change parent material into a soil with horizons. Usually, a long time is needed for the development of distinct horizons.

Parent Material

The parent material in Waushara County consists of windblown sand, water-laid deposits, organic material, and glacial drift. Glacial drift can be further divided into till and outwash.

Till is unsorted glacial debris composed of clay, silt, sand, and rock fragments. Two distinctly different types of till occur within the county. They were deposited during different periods of glaciation, known as substages *(10)*. The major substages are the Cary and Greatlakean. The latter substage has also been called the Valders substage. Each substage transported glacial debris and deposited it over the bedrock *(7)*, forming hills, valleys, depressions, and plains.

The earliest Wisconsinan substage was the Cary. Cary till is distinguished by its brown or dark brown color and its sand or loamy sand texture. Prominent ridges, irregular hills, and kettle lakes are characteristic of areas of this till. Rock fragments are common on the surface and throughout the soil profile. The major soils that formed in the till are Okee. The end moraine of this till is the abrupt range of hills that extends from the village of Plainfield to the village of Coloma.

The Greatlakean (Valders) ice overrode Cary till in the eastern part of the county. This till is distinguished by a reddish brown color, high calcium carbonate content, and loam or clay loam texture. The topography consists mostly of long, gentle slopes. Rock fragments are less common in this till than in the Cary till. The major soils that formed in the Greatlakean till are Hortonville and Symco. The end moraine of this till is very difficult to recognize on the landscape. The thickness of the till ranges from a trace to more than 150 feet.

Water from the melting ice masses deposited outwash sand or sand and gravel along the watercourses as stream terraces, eskers, kames, and outwash plains. The typical topography of these deposits is nearly level, but it ranges to steep. Gravel and cobbles are common on the surface in some areas of outwash. The major soils that formed in outwash are Boyer, Plainfield, and Richford.

Lacustrine deposits are stratified sandy, silty, or clayey layers that accumulated in the glacial lakes that formed when ice blocked drainage outlets. The largest glacial lake basin is in the eastern part of the county, surrounding modern Lake Poygan. The topography of this lake basin is nearly level or gently sloping and is characterized by many wet depressions. These deposits are generally free of rock fragments. The major soils that formed in lake-laid deposits are Poy and Zittau.

Organic material occurs in wet depressions throughout the county. The material consists of partly decomposed reeds, sedges, grasses, and, in some places, woody fragments. The topography in these depressions is nearly level. The major soils that formed

in organic material are Adrian, Houghton, and Willette.

Climate

In general, climate affects soil formation through the moisture and heat it contributes to the environment. It has a direct effect on the weathering of rock. It also alters parent material by freezing and thawing. The leaching by water also affects the movement of minerals and clay in soils. An indirect effect of climate on soil formation is its influence on the plant and animal community. The climate is nearly the same throughout Waushara County and has caused few differences among the soils in the county.

Plant and Animal Life

Plants and animals affect the formation of soils by providing organic matter and by transferring plant nutrients from the lower layers of the soil to the upper layers.

Most of the soils in the county formed under forest vegetation. These soils have a thin, moderately dark colored surface layer. They are classified as Alfisols and are exemplified by the Hortonville and Richford soils. A few soils in the county formed under grass, and these soils have a thick, dark colored surface layer. They are classified as Mollisols. Examples are the Poygan and Sparta soils. Many soils within the county formed under the influence of both grass and forest vegetation. These soils have a moderately thick, dark colored surface layer. They are exemplified by the Billett and Symco soils.

Farming activities since the mid-19th century have had an important influence upon the soils of Waushara County. They have greatly altered the original condition of the soils. In cultivated areas the native vegetation has been removed and the upper soil layers have been mixed. Many acres of wet soils have been drained. The soils have been overcultivated with heavy equipment that has caused compaction. The repeated removal of plant cover and cultivation have accelerated erosion. Examples of this erosion are evident on the sloping Hortonville soils. Some effects of human activities, such as those caused by additions of fertilizer and pesticide, may not be known for many years.

Relief

The relief of Waushara County is largely attributed to glacial activity. It varies from steep and rolling in morainic areas to nearly level on bottom lands and in depressions. Relief influences soil formation by controlling drainage, runoff, and other direct and indirect effects of water, including erosion. The natural drainage is determined, to a great extent, by relief and by the position of soils on the landscape.

In depressional areas, soils remain cool and wet, and as a result mineral soils are poorly drained and gleyed. Because decomposition of organic matter is slow, these soils have a thick surface layer that is high in content of organic matter. Examples of poorly drained mineral soils are Poy and Poygan.

Meehan and Symco are examples of somewhat poorly drained soils in drainageways. These soils receive runoff from higher lying areas during part of the growing season. They are mottled in the subsoil and substratum.

Soils in the more sloping areas are subject to more runoff, and consequently less water enters these soils than the soils that are nearly level. Such soils generally are not characterized by mottles or prolonged seasonal wetness and have horizons that are more distinct than those in wet soils. Examples of such soils are the well drained Hortonville and Kewaunee soils.

Time

Time is needed for the factors of soil formation to act on the parent material and alter it. It may be much or little, but some time is always required for the development of horizons. Soils can have a profile with distinct horizons, such as the one in Hortonville soils; a profile with little or no horizonation, such as the one in Plainfield soils; or a profile that is somewhere in between, such as the one in Boyer soils. The Salter and Yahara soils are examples of soils that show little horizonation and are considered to be weakly developed. The surface layer of these soils is the only distinct genetic horizon.

Processes of Soil Formation

The processes of soil formation are those interactions that form soil horizons. A soil horizon may be defined as a layer of soil, approximately parallel to the soil surface, that has characteristics produced by soil-forming factors. Horizons are distinguished by characteristics that can be observed in the field. Horizon boundaries generally are not abrupt but grade from one horizon to another.

Horizons form through one or more of the following processes: accumulation of organic matter, leaching of carbonates, translocation of silicate clay minerals, and reduction and transfer of iron.

Organic matter has accumulated in the surface layer of all soils in the county. The amount of organic matter

in the surface layer and the thickness of this layer vary significantly from one area to another. Coloma and Plainfield soils have a small amount of organic matter in the surface layer, and Poy and Poygan soils have a large amount. This difference is attributed mainly to the ability of the soils to support vegetation, but other factors include the type, amount, and rate of decomposition of the vegetation.

Leaching of carbonates has occurred in almost all of the soils in the county. Water moving through the soil has dissolved the carbonates and carried them deeper into the soil profile or to ground water level. This leaching has had little visible effect on horizon development, but it is necessary if the translocation of silicate clay is to take place. Hortonville and Symco are examples of leached soils. The parent material of these soils is very high in content of carbonates, but the surface layer and subsoil have been leached of carbonates.

The translocation of silicate clay minerals has contributed to subsoil development in many of the soils in the county. Silicate clay is removed from the surface layer by percolating water and is deposited in the subsoil. Clay accumulation is visible in the form of clay films on the surface of peds and in root channels. Soils in which the translocation of silicate clay minerals has taken place generally have distinct, subangular or angular blocky peds in the subsoil. Hortonville and Richford are examples of soils in which silicate clay translocation has occurred, resulting in more clay in the subsoil than in overlying horizons. In contrast, the sandy Plainfield soils have little clay to translocate from the surface layer, and so very little clay has accumulated in the subsoil.

Wet soils, such as Poy and Poygan, are saturated during much of the year and so are characterized by little downward percolation of water. Under these conditions, very little clay is translocated to the subsoil.

The reduction and transfer of iron have occurred in all poorly drained soils and in many of the somewhat poorly drained soils. This process has occurred because the iron in the soils has been reduced in the presence of water and organic matter and has been transferred. The iron may be transferred to part of the same horizon or completely out of the soil profile. In most of the soils in the county it has been transferred to part of the same horizon or to the adjacent horizon. Poy and Poygan are examples of soils in which a considerable amount of iron has been reduced and transferred, as is evidenced by the gleying or gray colors in the upper part of the subsoil. In somewhat poorly drained soils, such as Nebago and Symco, the process of reduction and transfer is less extensive than in the poorly drained soils; however, some reduction and transfer of iron have occurred, as is shown by gray spots called mottles. These gray mottles, or reduced iron, are also accompanied by segregated iron forms that are yellowish red, strong brown, or yellowish brown.

The processes of horizon development have been active in all soils in the county, but they differ in kind and in degree of expression. The different processes that have occurred in each soil determine the type and degree of horizonation. The horizonation of soils is one of the important characteristics that was observed in classifying and mapping the soils in Waushara County.

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Glossary

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of gravel or cobbles. In some blowouts the water table is exposed.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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 film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clayey. Clay, silty clay, or sandy clay.

Climax vegetation. 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.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic

crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial lake basin. A depression that was occupied by a lake during or after glaciation.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:
O horizon.—An organic layer of fresh and decaying plant residue.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.
Cr horizon.—Soft, consolidated bedrock beneath the soil.
R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Kettle lake. A body of water occupying a depression in a pitted outwash plain or in a kettle moraine.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (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. Clay loam, sandy clay loam, loam, very fine sandy loam, fine sandy loam, or sandy loam.

Low strength. The soil is not strong enough to support loads.

Mechanical site preparation. Use of equipment such as a heavy disk, a bulldozer, or a special blade to destroy competing vegetation and promote the germination and growth of desirable trees.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally

indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter is expressed as—

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Organic soil. A soil in which the content of organic carbon is 12 to 18 percent or more, depending on the content of mineral material. The organic layer is more than 16 inches thick.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

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.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil extending through all its horizons 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—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, gravel, 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. Loamy very fine sand, loamy fine sand, loamy sand, loamy coarse sand, very fine sand, fine sand, sand, or coarse sand.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Silty. Silt, silt loam, or silty clay loam.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

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. The slope classes in this county are—

Nearly level	0 to 2 percent
Gently sloping	2 to 6 percent
Sloping	6 to 12 percent
Moderately steep	12 to 20 percent
Steep	more than 20 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Spodic horizon. Subsurface horizon in which active amorphous materials, composed of organic matter and aluminum, with or without iron, have precipitated.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide

vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

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."

Tiers. Layers used to define the control section in the classification of soils. The organic material has been divided somewhat arbitrarily into three tiers—the surface, subsurface, and bottom 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.

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Vegetative row barriers. Narrow strips, or barriers, of wind resistant crops, such as rye or crested wheatgrass, planted in fields that are fallow or are to be planted to row crops. Strips are planted at right angle to the prevailing wind to reduce the risk of soil blowing.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Hancock, Wisconsin)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	23.6	2.7	13.2	47	-31	0	0.83	0.38	1.20	3	9.3
February----	29.2	6.9	18.1	51	-26	0	.99	.27	1.56	3	8.5
March-------	39.7	18.2	29.0	69	-18	9	1.87	.70	2.84	5	10.2
April-------	57.3	33.0	45.2	84	9	49	2.94	1.74	4.01	7	3.1
May---------	70.6	43.9	57.3	91	22	263	3.43	1.79	4.85	7	.1
June--------	79.1	53.7	66.4	94	35	492	3.44	2.22	4.53	7	.0
July--------	82.8	57.9	70.4	95	41	632	3.41	2.23	4.48	7	.0
August------	80.8	56.1	68.5	94	37	574	3.74	1.88	5.35	7	.0
September---	72.0	47.7	59.9	91	26	297	3.72	1.49	5.59	7	.0
October-----	60.7	37.9	49.3	84	15	112	2.30	.82	3.52	5	.4
November----	43.3	24.6	34.0	68	-3	6	1.68	.65	2.53	4	4.2
December----	28.9	10.8	19.9	53	-24	0	1.09	.52	1.56	4	9.6
Yearly:											
Average---	55.7	32.8	44.3	---	---	---	---	---	---	---	---
Extreme---	---	---	---	97	-32	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,434	29.44	24.58	34.05	66	45.4

* 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 1951-81 at Hancock, 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--	May 10	May 22	May 31
2 years in 10 later than--	May 5	May 16	May 26
5 years in 10 later than--	Apr. 27	May 6	May 16
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 2	Sept. 20	Sept. 14
2 years in 10 earlier than--	Oct. 7	Sept. 24	Sept. 18
5 years in 10 earlier than--	Oct. 16	Oct. 4	Sept. 24

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Hancock, 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	153	132	115
8 years in 10	160	138	120
5 years in 10	172	150	131
2 years in 10	184	162	142
1 year in 10	190	168	147

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ad	Adrian muck, 0 to 1 percent slopes	18,840	4.6
Be	Belleville loamy sand, 0 to 2 percent slopes	930	0.2
Bt	Billett sandy loam, 0 to 2 percent slopes	9,340	2.3
ByB	Boyer loamy sand, 2 to 6 percent slopes	10,140	2.5
ByC	Boyer loamy sand, 6 to 12 percent slopes	4,010	1.0
BzD	Boyer-Mecosta complex, 12 to 20 percent slopes	2,980	0.7
CoB	Coloma loamy sand, 2 to 6 percent slopes	5,540	1.4
CoC	Coloma loamy sand, 6 to 12 percent slopes	7,940	1.9
CoD	Coloma loamy sand, 12 to 30 percent slopes	4,000	1.0
FkA	Fisk loamy sand, 0 to 3 percent slopes	2,500	0.6
HnB	Hortonville fine sandy loam, 2 to 6 percent slopes	7,855	1.9
HrC2	Hortonville loam, 6 to 12 percent slopes, eroded	790	0.2
Hu	Houghton muck, 0 to 1 percent slopes	23,150	5.7
Hw	Houghton muck, ponded, 0 to 1 percent slopes	1,190	0.3
Ke	Keowns silt loam, 0 to 2 percent slopes	2,505	0.6
KnB	Kewaunee loam, 2 to 6 percent slopes	3,425	0.8
Ks	Kingsville loamy sand, 0 to 2 percent slopes	15,500	3.8
Le	Leola loamy sand, 0 to 2 percent slopes	2,560	0.6
MbA	Manawa silt loam, 0 to 3 percent slopes	4,150	1.0
MoA	Meehan loamy sand, 0 to 3 percent slopes	11,670	2.9
MrA	Morocco fine sand, 0 to 3 percent slopes	5,415	1.3
NeA	Nebago loamy fine sand, 0 to 3 percent slopes	2,695	0.6
OkB	Okee loamy sand, 2 to 6 percent slopes	5,240	1.3
OkC	Okee loamy sand, 6 to 12 percent slopes	10,775	2.6
OkD	Okee loamy sand, 12 to 20 percent slopes	7,610	1.9
Pa	Palms muck, 0 to 1 percent slopes	2,495	0.6
PbA	Pearl loamy sand, 0 to 3 percent slopes	6,825	1.7
Pe	Pits, gravel	430	0.1
PfA	Plainfield sand, 0 to 2 percent slopes	15,715	3.9
PfB	Plainfield sand, 2 to 6 percent slopes	42,762	10.5
PfC	Plainfield sand, 6 to 12 percent slopes	28,090	6.9
PfD	Plainfield sand, 12 to 30 percent slopes	18,640	4.6
PlB	Plainfield sand, loamy substratum, 2 to 6 percent slopes	910	0.2
PmA	Plainfield sand, wet substratum, 0 to 3 percent slopes	14,605	3.6
Pt	Poy clay, 0 to 2 percent slopes	7,685	1.9
Py	Poygan silty clay loam, 0 to 2 percent slopes	3,760	0.9
RfA	Richford loamy sand, 0 to 2 percent slopes	19,100	4.7
RfB	Richford loamy sand, 2 to 6 percent slopes	33,750	8.3
RfC	Richford loamy sand, 6 to 12 percent slopes	10,935	2.7
RfD	Richford loamy sand, 12 to 20 percent slopes	4,015	1.0
SaB	Salter very fine sandy loam, 2 to 6 percent slopes	290	0.1
Sp	Sparta loamy sand, 0 to 2 percent slopes	1,020	0.2
SwA	Symco loamy fine sand, 0 to 3 percent slopes	1,370	0.3
SyA	Symco silt loam, 0 to 3 percent slopes	7,695	1.9
TuB	Tustin loamy sand, 2 to 6 percent slopes	1,035	0.2
Wm	Willette muck, 0 to 1 percent slopes	3,490	0.9
YaA	Yahara very fine sandy loam, 0 to 3 percent slopes	1,760	0.4
ZtA	Zittau clay, 0 to 3 percent slopes	4,125	1.0
ZvA	Zittau Variant clay, 0 to 3 percent slopes	765	0.2
	Water	6,105	1.5
	Total	408,122	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
Bt	Billett sandy loam, 0 to 2 percent slopes
ByB	Boyer loamy sand, 2 to 6 percent slopes
FkA	Fisk loamy sand, 0 to 3 percent slopes (where drained)
HnB	Hortonville fine sandy loam, 2 to 6 percent slopes
Ke	Keowns silt loam, 0 to 2 percent slopes (where drained)
KnB	Kewaunee loam, 2 to 6 percent slopes
MbA	Manawa silt loam, 0 to 3 percent slopes (where drained)
NeA	Nebago loamy fine sand, 0 to 3 percent slopes (where drained)
OkB	Okee loamy sand, 2 to 6 percent slopes
Pt	Poy clay, 0 to 2 percent slopes (where drained)
Py	Poygan silty clay loam, 0 to 2 percent slopes (where drained)
SaB	Salter very fine sandy loam, 2 to 6 percent slopes
SwA	Symco loamy fine sand, 0 to 3 percent slopes (where drained)
SyA	Symco silt loam, 0 to 3 percent slopes (where drained)
YaA	Yahara very fine sandy loam, 0 to 3 percent slopes (where drained)
ZtA	Zittau clay, 0 to 3 percent slopes (where drained)
ZvA	Zittau Variant clay, 0 to 3 percent slopes (where drained)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Soybeans
		Bu	Tons	Bu	Tons	Tons	Bu
Ad---------- Adrian	VIw	---	---	---	---	---	---
Be---------- Belleville	VIw	---	---	---	---	---	---
Bt---------- Billett	IIIs	80	13	65	3.5	3.0	30
ByB---------- Boyer	IIIs	70	11	55	3.0	2.5	28
ByC---------- Boyer	IIIe	60	10	45	2.5	2.2	22
BzD---------- Boyer-Mecosta	VIIs	---	---	---	---	---	---
CoB---------- Coloma	IVs	60	10	50	2.8	2.0	18
CoC---------- Coloma	VIs	---	---	---	---	---	---
CoD---------- Coloma	VIIs	---	---	---	---	---	---
FkA---------- Fisk	IIIw	85	13	65	3.5	3.5	26
HnB---------- Hortonville	IIe	125	19	75	5.0	4.0	36
HrC2---------- Hortonville	IIIe	115	17	70	4.8	3.5	30
Hu---------- Houghton	VIw	---	---	---	---	---	---
Hw---------- Houghton	VIIIw	---	---	---	---	---	---
Ke---------- Keowns	IIIw	120	19	55	3.0	3.5	30
KnB---------- Kewaunee	IIe	115	17	70	5.0	4.0	34
Ks---------- Kingsville	IVw	75	12	55	3.0	2.0	25
Le---------- Leola	IIIw	80	12	60	3.0	2.0	24
MbA---------- Manawa	IIw	125	19	70	4.5	4.0	34
MoA---------- Meehan	IVw	65	11	45	2.6	2.0	23

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Soybeans
		Bu	Tons	Bu	Tons	Tons	Bu
MrA---------- Morocco	IVw	80	12	60	2.6	2.0	28
NeA---------- Nebago	IIIw	85	13	65	3.5	3.0	28
OkB---------- Okee	IIIs	70	12	65	3.5	2.5	24
OkC---------- Okee	IIIe	60	11	55	3.0	2.2	20
OkD---------- Okee	IVe	50	8	45	3.0	2.0	18
Pa---------- Palms	VIw	---	---	---	---	---	---
PbA---------- Pearl	IVs	70	11	55	3.5	2.0	24
Pe*. Pits							
PfA, PfB-------- Plainfield	IVs	55	7	50	2.5	2.0	16
PfC---------- Plainfield	VIs	---	---	---	2.0	2.0	---
PfD---------- Plainfield	VIIs	---	---	---	---	---	---
PlB---------- Plainfield	IVs	70	11	50	3.5	2.0	17
PmA---------- Plainfield	IVs	65	11	45	3.0	2.2	18
Pt---------- Poy	IIw	105	17	50	3.0	4.0	30
Py---------- Poygan	IIw	125	19	55	3.5	3.5	35
RfA, RfB-------- Richford	IIIs	60	10	55	3.0	2.2	22
RfC---------- Richford	IIIe	50	8	45	2.5	2.0	18
RfD---------- Richford	IVe	40	7	40	2.5	2.0	16
SaB---------- Salter	IIe	120	19	70	4.0	3.5	30
Sp---------- Sparta	IVs	55	9	50	2.5	2.0	25

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Soybeans
		Bu	Tons	Bu	Tons	Tons	Bu
SwA---------- Symco	IIw	115	17	65	4.5	3.5	32
SyA---------- Symco	IIw	125	19	70	4.5	4.0	34
TuB---------- Tustin	IIIe	80	12	60	3.5	3.0	25
Wm---------- Willette	VIw	---	---	---	---	---	---
YaA---------- Yahara	IIw	125	19	70	3.5	3.5	30
ZtA---------- Zittau	IIw	105	17	65	3.5	3.5	30
ZvA---------- Zittau Variant	IIw	120	18	65	3.5	3.5	30

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF IRRIGATED CROPS

(Yields are those that can be expected under a high level of management)

Soil name and map symbol	Land capability	Irish potatoes	Sweet corn	Canning peas	Snap beans	Cucumbers	Corn	Alfalfa hay
		Cwt	Tons	Lbs	Lbs	Cwt	Bu	Tons
Bt---------- Billett	IIe	500	9.0	6,000	9,000	250	160	6.5
ByB---------- Boyer	IIe	450	8.0	5,000	8,000	200	150	6.0
CoB---------- Coloma	IIIe	350	5.0	3,500	6,000	150	140	5.0
Ks---------- Kingsville	IVe	400	6.0	4,000	7,000	150	150	4.0
Le---------- Leola	IIe	475	9.0	5,500	8,500	250	150	4.5
MoA---------- Meehan	IVe	400	6.0	4,000	7,000	250	150	4.5
PbA---------- Pearl	IIIe	475	9.0	5,500	8,500	225	150	5.0
PfA---------- Plainfield	IIIe	400	6.0	4,000	7,000	200	140	5.0
PfB---------- Plainfield	IVe	350	5.0	3,500	6,000	150	130	4.5
PmA---------- Plainfield	IIIe	400	6.0	4,000	7,000	200	140	6.0
RfA---------- Richford	IIe	475	9.0	5,500	8,500	225	155	6.0
RfB---------- Richford	IIIe	450	8.0	5,000	8,000	175	145	5.5
Sp---------- Sparta	IIe	450	7.0	5,000	8,000	225	150	6.0

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	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
Ad---------- Adrian	2W	Slight	Severe	Severe	Severe	Red maple----------	53	34	---
						Silver maple--------	78	32	
						White ash----------	69	64	
						Quaking aspen-------	60	64	
						Tamarack----------	45	35	
						Green ash----------	69	64	
Be---------- Belleville	1W	Slight	Severe	Severe	Severe	Silver maple--------	64	20	Red maple, black spruce, white spruce.
						Red maple----------	---	---	
						White ash----------	---	---	
						Pin oak------------	---	---	
						Swamp white oak-----	---	---	
Bt---------- Billett	4A	Slight	Slight	Slight	Slight	Northern red oak----	60	51	Red pine, eastern white pine, white spruce, Norway spruce.
						White oak----------	---	---	
						Black oak----------	---	---	
						Northern pin oak----	---	---	
						Shagbark hickory----	---	---	
ByB, ByC-------- Boyer	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Eastern white pine, red pine, Norway spruce, imperial Carolina poplar.
						White oak----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						Black oak----------	---	---	
BzD**: Boyer----------	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	66	60	Eastern white pine, red pine, Norway spruce, imperial Carolina poplar.
						White oak----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						Black oak----------	---	---	
Mecosta--------	6R	Moderate	Moderate	Moderate	Slight	Red pine-----------	55	88	Red pine, eastern white pine, jack pine.
						White oak----------	---	---	
						Northern red oak----	---	---	
						Quaking aspen-------	---	---	
						Black oak----------	---	---	
CoB, CoC-------- Coloma	2S	Slight	Moderate	Moderate	Slight	Northern pin oak----	49	33	Red pine, eastern white pine, jack pine.
						Jack pine----------	---	---	
						Black oak----------	---	---	
						White oak----------	---	---	
						Eastern white pine--	---	---	
CoD---------- Coloma	2R	Moderate	Moderate	Moderate	Slight	Northern pin oak----	49	33	Red pine, eastern white pine, jack pine.
						Jack pine----------	---	---	
						Black oak----------	---	---	
						White oak----------	---	---	
						Eastern white pine--	---	---	

See footnotes 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	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
FkA---------- Fisk	8A	Slight	Slight	Slight	Slight	Eastern white pine--	60	121	Eastern white pine, white spruce, Norway spruce, silver maple, white ash.
						Red maple----------	---	---	
						White ash----------	---	---	
						American elm--------	---	---	
						Silver maple--------	---	---	
						Green ash----------	---	---	
HnB, HrC2------- Hortonville	3D	Slight	Slight	Slight	Moderate	Sugar maple---------	66	41	Eastern white pine, white spruce.
						Northern red oak----	---	---	
						American basswood---	---	---	
Hu---------- Houghton	3W	Slight	Severe	Severe	Severe	Tamarack-----------	52	45	---
						Silver maple--------	82	36	
						Red maple----------	56	36	
						White ash----------	56	44	
						Quaking aspen-------	60	64	
						Green ash----------	---	---	
						Northern white-cedar	37	55	
Ke---------- Keowns	6W	Slight	Severe	Severe	Severe	White ash----------	80	80	Silver maple, red maple, white ash.
						Silver maple--------	91	43	
						Red maple----------	80	50	
KnB---------- Kewaunee	4D	Slight	Slight	Moderate	Severe	Northern red oak----	62	53	Eastern white pine, white spruce, Norway spruce.
						Sugar maple---------	57	36	
						White ash----------	---	---	
						American basswood---	---	---	
Ks---------- Kingsville	3W	Slight	Severe	Severe	Severe	Red maple----------	75	47	Red maple, green ash, swamp white oak.
						Pin oak------------	80	62	
						Green ash----------	---	---	
						Black cherry--------	---	---	
						Eastern cottonwood--	---	---	
						Swamp white oak-----	---	---	
Le---------- Leola	5A	Slight	Slight	Slight	Slight	Jack pine----------	55	77	Jack pine, eastern white pine.
						Eastern white pine--	---	---	
						Northern pin oak----	---	---	
MbA---------- Manawa	3C	Slight	Severe	Moderate	Severe	Sugar maple---------	58	37	Red maple, green ash, white ash, white spruce, eastern white pine.
						Northern red oak----	59	49	
						White ash----------	71	67	
						Red maple----------	---	---	
						American basswood---	67	61	
MoA---------- Meehan	9W	Slight	Moderate	Slight	Moderate	Eastern white pine--	62	127	Eastern white pine, jack pine, white spruce, balsam fir, red pine, red maple.
						Jack pine----------	55	77	
						Northern pin oak----	60	48	
						Red pine-----------	50	99	
						Paper birch--------	---	---	
						Quaking aspen-------	---	---	
						Balsam fir---------	---	---	
						White spruce-------	---	---	
						Black spruce-------	---	---	

See footnotes 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	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
MrA---------- Morocco	9S	Slight	Moderate	Moderate	Slight	Eastern white pine--	62	127	Eastern white pine, red maple, white spruce.
						Northern red oak----	70	66	
						Red maple----------	72	44	
						Northern pin oak----	65	48	
NeA---------- Nebago	3S	Slight	Moderate	Moderate	Slight	Red maple----------	69	42	White spruce, eastern white pine, white ash, red maple.
						Northern red oak----	55	42	
						White ash----------	---	---	
						Eastern white pine--	63	130	
						American elm--------	---	---	
OkB, OkC-------- Okee	2A	Slight	Slight	Slight	Slight	Northern pin oak----	45	30	Red pine, jack pine, eastern white pine.
						Black oak----------	---	---	
OkD---------- Okee	2R	Moderate	Moderate	Slight	Slight	Northern pin oak----	45	30	Red pine, jack pine, eastern white pine.
						Black oak----------	---	---	
Pa---------- Palms	2W	Slight	Severe	Severe	Severe	Silver maple--------	80	34	---
						Red maple----------	55	35	
						White ash----------	---	---	
						Quaking aspen-------	---	---	
						Northern white-cedar	---	---	
						Tamarack-----------	---	---	
						Black ash----------	---	---	
PbA---------- Pearl	9A	Slight	Slight	Slight	Slight	Eastern white pine--	62	127	Red pine, eastern white pine, jack pine.
						Jack pine----------	55	77	
						Red pine-----------	---	---	
						Northern pin oak----	---	---	
PfA, PfB, PfC--- Plainfield	8S	Slight	Moderate	Moderate	Slight	Eastern white pine--	58	115	Red pine, eastern white pine, jack pine.
						Red pine-----------	55	88	
						Jack pine----------	49	65	
						Northern pin oak----	48	32	
PfD---------- Plainfield	8R	Moderate	Moderate	Moderate	Slight	Eastern white pine--	58	115	Red pine, eastern white pine, jack pine.
						Red pine-----------	55	88	
						Jack pine----------	49	65	
						Northern pin oak----	48	32	
PlB---------- Plainfield	8S	Slight	Moderate	Moderate	Slight	Eastern white pine--	58	115	Red pine, eastern white pine, jack pine.
						Red pine-----------	58	88	
						Jack pine----------	---	---	
						Northern pin oak----	---	---	
PmA---------- Plainfield	8S	Slight	Moderate	Moderate	Slight	Eastern white pine--	58	115	Red pine, eastern white pine, jack pine.
						Red pine-----------	55	88	
						Jack pine----------	49	65	
						Northern pin oak----	48	32	
						Black oak----------	---	---	
						White oak----------	---	---	

See footnotes 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	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
Pt---------- Poy	4W	Slight	Severe	Severe	Severe	Red maple----------	86	53	Red maple, silver maple, white ash, green ash, white spruce.
						Swamp white oak-----	---	---	
						Northern red oak----	---	---	
						White ash----------	80	80	
						Silver maple--------	---	---	
						American elm--------	---	---	
						Green ash----------	---	---	
						American basswood---	---	---	
Py---------- Poygan	4W	Slight	Severe	Severe	Severe	White ash----------	65	59	White spruce, black spruce, red maple, silver maple.
						Red maple----------	---	---	
						Silver maple--------	---	---	
						American elm--------	---	---	
RfA, RfB, RfC--- Richford	4A	Slight	Slight	Slight	Slight	Northern red oak----	61	53	Eastern white pine, red pine, jack pine, eastern redcedar.
						Red pine----------	49	73	
						Eastern white pine--	61	124	
RfD---------- Richford	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	61	53	Eastern white pine, red pine, jack pine, eastern redcedar.
						Red pine----------	49	73	
						Eastern white pine--	61	124	
SaB---------- Salter	4A	Slight	Slight	Slight	Slight	Northern red oak----	67	61	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	---	
						American basswood---	---	---	
						Red maple----------	---	---	
						White ash----------	---	---	
Sp---------- Sparta	6S	Slight	Moderate	Slight	Slight	Jack pine----------	57	80	Red pine, eastern white pine, jack pine.
						Northern red oak----	47	30	
						Red pine----------	---	---	
SwA, SyA-------- Symco	6A	Slight	Slight	Slight	Slight	Northern red oak----	79	79	Red maple, eastern white pine, white ash, white spruce.
						Red maple----------	---	---	
						White ash----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
TuB---------- Tustin	3A	Slight	Slight	Slight	Slight	Black oak----------	55	38	Red pine, eastern white pine, Norway spruce.
						Red pine----------	---	---	
						Eastern white pine--	---	---	
						Northern red oak----	---	---	
Wm---------- Willette	2W	Slight	Severe	Severe	Severe	Red maple----------	51	33	---
						Silver maple--------	76	30	
						White ash----------	51	35	
						Northern white-cedar	27	39	
						Tamarack-----------	45	35	
						Black ash----------	---	---	
YaA---------- Yahara	4A	Slight	Slight	Slight	Slight	Northern red oak----	69	64	Eastern white pine, white spruce, silver maple, white ash.
						Sugar maple---------	---	---	
						Red maple----------	---	---	
						American basswood---	---	---	
						American beech------	---	---	

See footnotes 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	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
ZtA---------- Zittau	3C	Slight	Severe	Severe	Severe	Red maple----------	77	48	Eastern white pine, white spruce, white ash, red maple.
						Silver maple--------	80	34	
						White ash----------	75	73	
						Eastern white pine--	59	118	
						Northern red oak----	67	61	
						American elm--------	---	---	
						American basswood---	---	---	
ZvA---------- Zittau Variant	3C	Slight	Severe	Severe	Severe	Red maple----------	75	47	Red maple, green ash, white ash, white spruce, eastern white pine.
						Sugar maple--------	58	37	
						Northern red oak----	59	49	
						White ash----------	71	67	
						American basswood---	67	61	

* 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.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ad---------- Adrian	---	Silky dogwood, common ninebark, Amur privet, American cranberrybush, late lilac, Japanese tree lilac, nannyberry viburnum.	Northern white-cedar.	Eastern white pine, Siberian crabapple, green ash.	Imperial Carolina poplar.
Be---------- Belleville	---	Silky dogwood, Austrian pine.	Black spruce, northern white-cedar, Norway spruce.	---	Imperial Carolina poplar.
Bt---------- Billett	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, eastern redcedar.	Norway spruce, green ash, Amur maple, white ash.	Jack pine, red pine, eastern white pine.	---
ByB, ByC---------- Boyer	---	Siberian peashrub, nannyberry viburnum, lilac, Roselow sargent crabapple, eastern redcedar.	Red pine, white spruce, jack pine, green ash, Norway spruce.	Eastern white pine	Imperial Carolina poplar.
BzD*: Boyer----------	---	Siberian peashrub, nannyberry viburnum, lilac, Roselow sargent crabapple, eastern redcedar.	Red pine, white spruce, jack pine, green ash, Norway spruce.	Eastern white pine	Imperial Carolina poplar.
Mecosta----------	Manyflower cotoneaster.	Eastern redcedar, common ninebark, Siberian peashrub, lilac, Roselow sargent crabapple.	Jack pine, Siberian crabapple, red pine.	Eastern white pine	---
CoB, CoC, CoD----- Coloma	Manyflower cotoneaster.	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---

See footnote at end of table.

TABLE 9.--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
FkA---------- Fisk	---	Northern white-cedar, redosier dogwood, lilac, American cranberrybush, nannyberry viburnum, silky dogwood.	White spruce------	Eastern white pine, red pine, white ash, silver maple, red maple.	---
HnB, HrC2--------- Hortonville	---	Silky dogwood, northern white-cedar, lilac, American cranberrybush, Amur maple, gray dogwood.	White spruce, Norway spruce.	Eastern white pine, white ash, red maple.	---
Hu---------- Houghton	---	Silky dogwood, late lilac, Amur privet, common ninebark, nannyberry viburnum.	Japanese tree lilac, northern white-cedar.	Green ash, Siberian crabapple.	Imperial Carolina poplar.
Hw. Houghton					
Ke---------- Keowns	---	Northern white-cedar, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood, common ninebark.	White spruce, balsam fir.	Silver maple, white ash, green ash, red maple.	---
KnB---------- Kewaunee	---	Nannyberry viburnum, Amur maple, northern white-cedar, lilac, silky dogwood, alternateleaf dogwood, American cranberrybush, gray dogwood.	White spruce------	Eastern white pine, white ash, red maple.	---
Ks---------- Kingsville	---	Amur privet, American cranberrybush, silky dogwood.	Norway spruce, northern white-cedar, blue spruce, Washington hawthorn.	Eastern white pine, white ash.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 9.--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
Le---------- Leola	---	Northern white-cedar, redosier dogwood, nannyberry viburnum, American cranberrybush, silky dogwood, lilac.	White spruce------	Eastern white pine, white ash, red pine, silver maple, red maple.	---
MbA---------- Manawa	---	Alternateleaf dogwood, northern white-cedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	White spruce------	Eastern white pine, red pine, white ash, red maple.	---
MoA---------- Meehan	---	Redosier dogwood, silky dogwood, nannyberry viburnum, American cranberrybush, lilac, northern white-cedar.	White spruce------	Red maple, white ash, silver maple, red pine, eastern white pine.	---
MrA---------- Morocco	---	Lilac, silky dogwood, American cranberrybush, nannyberry viburnum.	Norway spruce, black spruce, white spruce.	Eastern white pine, red pine, jack pine.	Green ash, imperial Carolina poplar.
NeA---------- Nebago	---	Red maple, northern white-cedar, silky dogwood, American cranberrybush, lilac, redosier dogwood, nannyberry viburnum.	White spruce------	Eastern white pine, white ash, red pine, silver maple.	---
OkB, OkC, OkD----- Okee	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, Amur maple, American cranberrybush, lilac, eastern redcedar.	Norway spruce-----	Jack pine, red pine, eastern white pine.	---
Pa---------- Palms	---	Silky dogwood, common ninebark, nannyberry viburnum, American cranberrybush.	Northern white-cedar, Manchurian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 9.--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
PbA---------- Pearl	Manyflower cotoneaster.	Siberian peashrub, lilac, silky dogwood, gray dogwood, eastern redcedar, Amur maple, American cranberrybush.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
Pe*. Pits					
PfA, PfB, PfC, PfD---------- Plainfield	Manyflower cotoneaster.	Siberian peashrub, lilac, eastern redcedar, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
PlB---------- Plainfield	Manyflower cotoneaster.	Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
PmA---------- Plainfield	Manyflower cotoneaster.	Silky dogwood, gray dogwood, Siberian peashrub, American cranberrybush, lilac, Amur maple, eastern redcedar.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
Pt---------- Poy	---	Northern white-cedar, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood, common ninebark.	White spruce, balsam fir.	Silver maple, white ash, green ash, red maple.	---
Py---------- Poygan	---	Northern white-cedar, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood, common ninebark.	White spruce, balsam fir.	Silver maple, green ash, white ash, red maple.	---

See footnote at end of table.

TABLE 9.--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
RfA, RfB, RfC, RfD---------- Richford	Manyflower cotoneaster.	Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
SaB---------- Salter	Manyflower cotoneaster.	Eastern redcedar, American cranberrybush, silky dogwood, lilac, gray dogwood, Siberian peashrub, Amur maple.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
Sp---------- Sparta	Manyflower cotoneaster.	Siberian peashrub, Amur maple, lilac, eastern redcedar, American cranberrybush, gray dogwood, silky dogwood.	Norway spruce-----	Red pine, eastern white pine, jack pine.	---
SwA, SyA---------- Symco	---	Northern white-cedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce------	Eastern white pine, red pine, white ash, red maple, silver maple.	---
TuB---------- Tustin	Manyflower cotoneaster.	Siberian peashrub, lilac, eastern redcedar, silky dogwood, Amur maple, gray dogwood, American cranberrybush.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
Wm---------- Willette	American cranberrybush.	Silky dogwood, nannyberry viburnum, common ninebark, lilac, white spruce.	Northern white-cedar, green ash, Manchurian crabapple.	Eastern white pine, Norway spruce.	---
YaA---------- Yahara	---	Northern white-cedar, lilac, American cranberrybush, silky dogwood, redosier dogwood, nannyberry viburnum.	White spruce------	Eastern white pine, red pine, white ash, silver maple, red maple.	---

See footnote at end of table.

TABLE 9.--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
ZtA---------- Zittau	---	Northern white-cedar, American cranberrybush, silky dogwood, lilac, nannyberry viburnum, redosier dogwood.	White spruce------	Eastern white pine, red pine, red maple, white ash, silver maple.	---
ZvA---------- Zittau Variant	---	Northern white-cedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, gray dogwood.	White spruce------	Eastern white pine, red pine, white ash, red maple, silver maple.	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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 Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Be Belleville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Bt Billett	Slight	Slight	Slight	Slight	Moderate: droughty.
ByB Boyer	Slight	Slight	Moderate: slope.	Slight	Slight.
ByC Boyer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
BzD*: Boyer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Mecosta	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: droughty, slope.
CoB Coloma	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: large stones, droughty.
CoC Coloma	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: large stones, droughty, slope.
CoD Coloma	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: slope.
FkA Fisk	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
HnB Hortonville	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
HrC2 Hortonville	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: large stones, slope.
Hu Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Hw Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ke---------- Keowns	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
KnB---------- Kewaunee	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Ks---------- Kingsville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Le---------- Leola	Moderate: wetness.	Moderate: wetness.	Moderate: small stones, wetness.	Moderate: wetness.	Moderate: wetness, droughty.
MbA---------- Manawa	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
MoA---------- Meehan	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
MrA---------- Morocco	Severe: wetness, too sandy.	Severe: too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Moderate: wetness, droughty.
NeA---------- Nebago	Severe: wetness.	Moderate: wetness, too sandy, percs slowly.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
OkB---------- Okee	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
OkC---------- Okee	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: slope, droughty.
OkD---------- Okee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
Pa---------- Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
PbA---------- Pearl	Moderate: too sandy.	Moderate: too sandy.	Moderate: small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
Pe*. Pits					
PfA, PfB---------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
PfC---------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
PfD---------- Plainfield	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty, slope.
PlB, PmA---------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Pt---------- Poy	Severe: ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
Py---------- Poygan	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
RfA---------- Richford	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
RfB---------- Richford	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
RfC---------- Richford	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
RfD---------- Richford	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
SaB---------- Salter	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Sp---------- Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
SwA, SyA---------- Symco	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
TuB---------- Tustin	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Wm---------- Willette	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
YaA---------- Yahara	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
ZtA---------- Zittau	Severe: wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
ZvA---------- Zittau Variant	Severe: wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--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---- Adrian	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Be---- Belleville	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Very poor.	Poor	Fair.
Bt---- Billett	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ByB, ByC---- Boyer	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BzD*:										
Boyer----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Mecosta----	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
CoB---- Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
CoC---- Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
CoD---- Coloma	Very poor.	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
FkA---- Fisk	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
HnB, HrC2---- Hortonville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Hu---- Houghton	Very poor.	Poor	Poor	Fair	Fair	Good	Good	Poor	Poor	Good.
Hw---- Houghton	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Ke---- Keowns	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
KnB---- Kewaunee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ks---- Kingsville	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Le---- Leola	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
MbA---- Manawa	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 11.--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
MoA---- Meehan	Poor	Fair	Good	Fair	Fair	Fair	Poor	Poor	Fair	Poor.
MrA---- Morocco	Fair	Poor	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
NeA---- Nebago	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
OkB, OkC---- Okee	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
OkD---- Okee	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Pa---- Palms	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
PbA---- Pearl	Poor	Fair	Good	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
Pe*. Pits										
PfA, PfB---- Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
PfC, PfD---- Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
PlB---- Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
PmA---- Plainfield	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Pt---- Poy	Good	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
Py---- Poygan	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
RfA, RfB, RfC---- Richford	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
RfD---- Richford	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
SaB---- Salter	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Sp---- Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
SwA, SyA---- Symco	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
TuB---- Tustin	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--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
Wm---------- Willette	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
YaA---------- Yahara	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
ZtA---------- Zittau	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
ZvA---------- Zittau Variant	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--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---------- Adrian	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.
Be---------- Belleville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Bt---------- Billett	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
ByB---------- Boyer	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: small stones.
ByC---------- Boyer	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
BzD*: Boyer----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mecosta----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
CoB---------- Coloma	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: large stones, droughty.
CoC---------- Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
CoD---------- Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
FkA---------- Fisk	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
HnB---------- Hortonville	Moderate: dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: large stones.
HrC2---------- Hortonville	Moderate: dense layer, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: large stones, slope.

See footnote at end of table.

TABLE 12.--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
Hu---------- Houghton	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.
Hw---------- Houghton	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.
Ke---------- Keowns	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
KnB---------- Kewaunee	Moderate: too clayey, dense layer.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Ks---------- Kingsville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Le---------- Leola	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
MbA---------- Manawa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
MoA---------- Meehan	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
MrA---------- Morocco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
NeA---------- Nebago	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
OkB---------- Okee	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
OkC---------- Okee	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
OkD---------- Okee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pa---------- Palms	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
PbA---------- Pearl	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.

See footnote at end of table.

TABLE 12.--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
Pe*. Pits						
PfA---------- Plainfield	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
PfB---------- Plainfield	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: droughty.
PfC---------- Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
PfD---------- Plainfield	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
PlB---------- Plainfield	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: droughty.
PmA---------- Plainfield	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Severe: droughty.
Pt---------- Poy	Severe: cutbanks cave, ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
Py---------- Poygan	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
RfA---------- Richford	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
RfB---------- Richford	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
RfC---------- Richford	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
RfD---------- Richford	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SaB---------- Salter	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Slight.
Sp---------- Sparta	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
SwA, SyA---------- Symco	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: large stones, wetness.
TuB---------- Tustin	Severe: cutbanks cave.	Slight---------	Severe: shrink-swell.	Moderate: slope.	Moderate: frost action.	Moderate: droughty.

See footnote at end of table.

TABLE 12.--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
Wm---------- Willette	Severe: excess humus, ponding.	Severe: ponding, low strength, subsides.	Severe: ponding, shrink-swell, subsides.	Severe: ponding, low strength, subsides.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
YaA---------- Yahara	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
ZtA---------- Zittau	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
ZvA---------- Zittau Variant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Severe: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "poor," 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 Adrian	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Be Belleville	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
Bt Billett	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
ByB Boyer	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ByC Boyer	Severe:* poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
BzD**: Boyer	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Mecosta	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
CoB Coloma	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
CoC Coloma	Severe:* poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
CoD Coloma	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
FkA Fisk	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
HnB Hortonville	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.

See footnotes at end of table.

TABLE 13.--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
HrC2---------- Hortonville	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
Hu---------- Houghton	Severe: subsides, ponding.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Hw---------- Houghton	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Ke---------- Keowns	Severe: ponding.	Severe: ponding.	Severe: ponding, too sandy.	Severe: ponding.	Poor: ponding.
KnB---------- Kewaunee	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Ks---------- Kingsville	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Le---------- Leola	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
MbA---------- Manawa	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
MoA---------- Meehan	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
MrA---------- Morocco	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
NeA---------- Nebago	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
OkB---------- Okee	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
OkC---------- Okee	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.

See footnotes at end of table.

TABLE 13.--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
OkD---------- Okee	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Pa---------- Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
PbA---------- Pearl	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
Pe**. Pits					
PfA, PfB---------- Plainfield	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
PfC---------- Plainfield	Severe:* poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
PfD---------- Plainfield	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
PlB---------- Plainfield	Severe:* poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
PmA---------- Plainfield	Severe:* poor filter.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Pt---------- Poy	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Py---------- Poygan	Severe: ponding, percs slowly.	Slight----------	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
RfA, RfB---------- Richford	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
RfC---------- Richford	Severe:* poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnotes at end of table.

TABLE 13.--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
RfD---------- Richford	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
SaB---------- Salter	Severe: wetness.	Moderate: seepage, wetness.	Severe: wetness, too sandy.	Severe: wetness.	Fair: too sandy, wetness.
Sp---------- Sparta	Severe:* poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
SwA, SyA---------- Symco	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
TuB---------- Tustin	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
Wm---------- Willette	Severe: ponding, percs slowly, subsides.	Severe: excess humus, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
YaA---------- Yahara	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.
ZtA---------- Zittau	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
ZvA---------- Zittau Variant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

* The poor filtering capacity can result in the pollution of ground water.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--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 Adrian	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Be Belleville	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Bt Billett	Good	Probable	Probable	Poor: small stones.
ByB, ByC Boyer	Good	Probable	Probable	Poor: small stones, area reclaim.
BzD*: Boyer	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Mecosta	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
CoB, CoC Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
CoD Coloma	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
FkA Fisk	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
HnB, HrC2 Hortonville	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Hu Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
Hw Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Ke Keowns	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
KnB Kewaunee	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ks---------- Kingsville	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy, wetness.
Le---------- Leola	Fair: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim.
MbA---------- Manawa	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
MoA---------- Meehan	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy.
MrA---------- Morocco	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy.
NeA---------- Nebago	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
OkB, OkC---------- Okee	Good----------	Probable----------	Probable----------	Poor: area reclaim.
OkD---------- Okee	Fair: slope.	Probable----------	Probable----------	Poor: area reclaim, slope.
Pa---------- Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
PbA---------- Pearl	Fair: wetness.	Probable----------	Probable----------	Poor: small stones.
Pe*. Pits				
PfA, PfB, PfC--------- Plainfield	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
PfD---------- Plainfield	Fair: slope.	Probable----------	Improbable: too sandy.	Poor: too sandy, slope.
PlB, PmA---------- Plainfield	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
Pt---------- Poy	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: too clayey, wetness.
Py---------- Poygan	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
RfA, RfB---------- Richford	Good----------	Probable----------	Probable----------	Fair: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RfC---------- Richford	Good----------	Probable----------	Probable----------	Fair: too sandy, slope.
RfD---------- Richford	Fair: slope.	Probable----------	Probable----------	Poor: slope.
SaB---------- Salter	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Sp---------- Sparta	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
SwA, SyA---------- Symco	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
TuB---------- Tustin	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Wm---------- Willette	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
YaA---------- Yahara	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
ZtA---------- Zittau	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: too clayey.
ZvA---------- Zittau Variant	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--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---------- Adrian	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Ponding, too sandy, soil blowing.	Wetness, rooting depth.
Be---------- Belleville	Severe: seepage.	Severe: ponding.	Ponding, frost action.	Ponding, droughty, fast intake.	Ponding, soil blowing.	Wetness, droughty.
Bt---------- Billett	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
ByB---------- Boyer	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty.
ByC---------- Boyer	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
BzD*: Boyer----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
Mecosta----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, too sandy.	Large stones, slope, droughty.
CoB---------- Coloma	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
CoC, CoD---------- Coloma	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
FkA---------- Fisk	Severe: seepage.	Severe: piping, wetness.	Frost action---	Wetness, fast intake.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily
HnB---------- Hortonville	Moderate: slope.	Severe: piping.	Deep to water	Slope, percs slowly.	Erodes easily, soil blowing.	Erodes easily, rooting depth
HrC2---------- Hortonville	Severe: slope.	Severe: piping.	Deep to water	Slope, percs slowly.	Slope, erodes easily.	Slope, erodes easily rooting depth
Hu---------- Houghton	Severe: seepage.	Severe: excess humus, ponding.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.

See footnote at end of table.

TABLE 15.--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
Hw---------- Houghton	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides, frost action.	Ponding--------	Ponding--------	Wetness.
Ke---------- Keowns	Moderate: seepage.	Severe: piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding--------	Erodes easily, ponding.	Wetness, erodes easily.
KnB---------- Kewaunee	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, rooting depth.	Erodes easily	Percs slowly, erodes easily.
Ks---------- Kingsville	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
Le---------- Leola	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
MbA---------- Manawa	Slight---------	Severe: hard to pack.	Percs slowly, frost action.	Wetness--------	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
MoA---------- Meehan	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
MrA---------- Morocco	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Droughty, fast intake, wetness.	Wetness, too sandy, soil blowing.	Wetness, droughty.
NeA---------- Nebago	Severe: seepage.	Severe: hard to pack.	Percs slowly---	Wetness, droughty.	Wetness, soil blowing, percs slowly.	Wetness, droughty, rooting depth.
OkB---------- Okee	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
OkC, OkD---------- Okee	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Pa---------- Palms	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
PbA---------- Pearl	Severe: seepage.	Severe: seepage, piping.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
Pe*. Pits						
PfA---------- Plainfield	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 15.--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
PfB---------- Plainfield	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
PfC, PfD---------- Plainfield	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
PlB---------- Plainfield	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
PmA---------- Plainfield	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Pt---------- Poy	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, percs slowly, frost action.	Ponding, droughty, slow intake.	Erodes easily, ponding, too sandy.	Wetness, erodes easily, droughty.
Py---------- Poygan	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, droughty, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, rooting depth.
RfA---------- Richford	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
RfB---------- Richford	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
RfC, RfD---------- Richford	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
SaB---------- Salter	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Sp---------- Sparta	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
SwA---------- Symco	Slight---------	Severe: wetness.	Frost action---	Wetness, fast intake, soil blowing.	Wetness, soil blowing.	Wetness, rooting depth.
SyA---------- Symco	Slight---------	Severe: wetness.	Frost action---	Wetness--------	Wetness--------	Wetness, rooting depth.
TuB---------- Tustin	Severe: seepage.	Severe: hard to pack.	Deep to water	Slope, droughty, fast intake.	Erodes easily, soil blowing.	Erodes easily, droughty.
Wm---------- Willette	Severe: seepage.	Severe: ponding.	Ponding, percs slowly, subsides.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.

See footnote at end of table.

TABLE 15.--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
YaA---------- Yahara	Moderate: seepage.	Severe: piping, wetness.	Frost action, cutbanks cave.	Wetness, soil blowing.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
ZtA---------- Zittau	Severe: seepage.	Severe: seepage, piping, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, droughty.
ZvA---------- Zittau Variant	Moderate: seepage.	Severe: piping, wetness.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ad	0-32	Sapric material	PT	A-8	---	---	---	---	---	---	---
Adrian	32-60	Sand, loamy sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
Be	0-10	Loamy sand	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
Belleville	10-30	Fine sand, sand, loamy fine sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	30-60	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
Bt	0-8	Sandy loam	SM, SM-SC, SC	A-2, A-4	0-5	90-100	90-100	60-100	25-50	<26	NP-8
Billett	8-28	Sandy loam, fine sandy loam.	SM, SM-SC, SC	A-2, A-4	0-15	90-100	80-95	80-95	25-50	<28	NP-9
	28-60	Sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, SP, GP	A-2, A-3, A-4, A-1	0-15	55-80	45-80	20-95	2-40	---	NP
ByB, ByC	0-10	Loamy sand	SM, SM-SC	A-2, A-1, A-4	0-5	95-100	65-95	45-75	15-45	<20	NP-6
Boyer	10-22	Sandy loam, loam, loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	22-60	Gravelly sand, sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
BzD*:											
Boyer	0-10	Loamy sand	SM, SM-SC	A-2, A-1, A-4	0-5	95-100	65-95	45-75	15-45	<20	NP-6
	10-22	Sandy loam, loam, loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	22-60	Gravelly sand, sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
Mecosta	0-8	Gravelly loamy sand.	SM, SM-SC, SP-SM	A-2-4, A-1-b	0-15	75-100	65-100	45-80	10-30	<20	NP-5
	8-15	Gravelly loamy sand, loamy sand.	SM-SC, SM, SP-SM, GM	A-2-4, A-1-b	0-15	40-70	40-70	35-65	10-30	<20	NP-5
	15-60	Gravelly sand, gravelly coarse sand, very gravelly sand.	GP-GM, GP	A-1-A, A-1-b	0-25	20-50	20-50	20-50	0-10	---	NP
CoB, CoC, CoD	0-4	Loamy sand	SM	A-2, A-4	0-8	75-100	75-100	50-90	15-50	---	NP
Coloma	4-39	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0-8	75-100	75-100	50-75	2-30	---	NP
	39-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-8	75-100	75-100	50-100	2-40	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
FkA----------	0-8	Loamy sand-------	SM	A-2	0	100	100	80-100	15-30	---	NP
Fisk	8-33	Sand, loamy sand	SP-SM, SM	A-2, A-3	0	100	100	80-100	5-30	---	NP
	33-36	Fine sandy loam	SM, SC, ML, CL	A-2, A-4	0	100	100	80-100	30-75	<28	4-9
	36-60	Silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	90-100	50-90	<28	4-9
HnB----------	0-8	Fine sandy loam	SM, ML, SC, CL	A-4, A-2	0-7	80-100	75-100	55-90	25-60	<26	1-8
Hortonville	8-35	Clay loam, loam, silty clay loam.	CL, CH, SC	A-7, A-6	0-7	80-100	75-100	65-100	45-95	35-60	15-40
	35-60	Fine sandy loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-2	0-7	75-100	75-100	50-100	30-85	20-40	4-20
HrC2----------	0-6	Loam----------	CL, CL-ML, SC, SM-SC	A-4	0-7	80-100	75-100	65-100	45-100	20-30	4-9
Hortonville	6-26	Clay loam, loam, silty clay loam.	CL, CH, SC	A-7, A-6	0-7	80-100	75-100	65-100	45-95	35-60	15-40
	26-60	Fine sandy loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-2	0-7	75-100	75-100	50-100	30-85	20-40	4-20
Hu----------	0-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
Houghton											
Hw----------	0-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
Houghton											
Ke----------	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-30	4-11
Keowns	13-29	Silt loam, very fine sandy loam.	SC, CL, ML, SM	A-4, A-2	0	100	100	60-100	30-90	<28	4-9
	29-60	Stratified silt to fine sand.	ML, SM, CL, SC	A-2, A-4	0	100	100	80-100	30-95	<28	1-9
KnB----------	0-8	Loam----------	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	80-100	50-90	20-30	6-11
Kewaunee	8-32	Clay, silty clay loam.	CL, CH	A-7	0-5	85-100	80-100	75-100	60-95	40-70	25-50
	32-60	Silty clay loam, silty clay, clay.	CL, CH	A-7	0-5	85-100	80-100	75-100	60-95	40-70	15-45
Ks----------	0-7	Loamy sand-------	SM	A-2, A-4	0	100	90-100	50-80	15-45	---	NP
Kingsville	7-15	Fine sand, sand	SM, SP-SM	A-2, A-4	0	100	90-100	50-80	10-45	---	NP
	15-60	Fine sand, sand, loamy fine sand.	SM, SW-SM, SP-SM	A-2, A-3, A-4, A-1	0	95-100	85-100	45-80	5-45	---	NP
Le----------	0-8	Loamy sand-------	SM, SP-SM	A-1, A-2	0	75-100	75-100	40-75	10-30	---	NP
Leola	8-31	Loamy sand-------	SM, SP-SM	A-1, A-2	0-10	75-100	75-100	40-75	10-30	---	NP
	31-37	Loamy sand, sandy loam.	SM, SM-SC	A-1, A-2, A-4	0-10	75-100	75-100	40-90	15-40	<20	NP-6
	37-44	Loamy sand-------	SM, SP-SM, SW-SM	A-1, A-2	0-10	75-100	75-100	40-90	10-30	---	NP
	44-60	Sand, gravelly sand.	SP, SM, SW, SW-SM	A-1, A-3, A-2	0-10	55-100	55-100	30-95	1-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MbA---------- Manawa	0-9	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	7-15
	9-29	Silty clay, silty clay loam, clay.	CH, CL	A-7	0-5	85-100	80-100	80-100	65-95	45-80	25-50
	29-60	Silty clay, silty clay loam, clay loam.	CH, CL	A-6, A-7	0-5	85-100	80-100	80-100	65-100	30-80	15-50
MoA---------- Meehan	0-8	Loamy sand-------	SM	A-2, A-1	0	90-100	75-100	40-90	15-30	---	NP
	8-33	Sand, loamy sand, loamy coarse sand.	SM, SP-SM, SP	A-1, A-2, A-3	0	90-100	75-100	40-90	3-30	---	NP
	33-60	Sand, coarse sand	SP, SP-SM	A-1, A-3, A-2	0	90-100	75-100	40-90	0-5	---	NP
MrA---------- Morocco	0-8	Fine sand--------	SM, SM-SC	A-2-4	0	100	100	65-85	20-35	<20	NP-5
	8-60	Fine sand, sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
NeA---------- Nebago	0-9	Loamy fine sand	SM	A-2	0	100	100	80-100	15-35	---	NP
	9-24	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	80-100	5-35	---	NP
	24-60	Silty clay, clay	CL, CH	A-7	0-5	85-100	85-100	85-100	70-100	45-90	20-60
OkB, OkC, OkD---- Okee	0-6	Loamy sand-------	SM, SP-SM	A-2, A-4, A-1-b	0-10	90-100	90-100	45-85	10-40	---	NP
	6-23	Loamy sand, sand	SM, SP-SM, SP	A-2, A-3, A-4, A-1-b	0-10	90-100	90-100	45-85	3-40	---	NP
	23-35	Sandy clay loam, sandy loam.	SC, SM, ML, CL	A-2, A-4	0-10	90-100	90-100	50-90	20-55	<25	2-10
	35-42	Sandy loam, loamy sand.	SM, SP-SM	A-2, A-4, A-1-b	0-10	85-100	85-100	40-75	10-40	<15	NP-3
	42-60	Loamy sand, sand, gravelly sand.	SP, SP-SM	A-2, A-3,	1-15	75-95	75-95	50-75	3-15	---	NP
Pa---------- Palms	0-26	Sapric material	PT	A-8	---	---	---	---	---	---	---
	26-60	Silty clay loam, fine sandy loam, silt loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
PbA---------- Pearl	0-8	Loamy sand-------	SM, SP-SM	A-1, A-2	0	75-100	75-100	40-75	10-30	---	NP
	8-36	Loamy sand, sand	SM, SP-SM, SP	A-1, A-3, A-2	0	75-100	75-100	40-90	3-30	---	NP
	36-40	Sandy loam, loamy sand.	SM, SM-SC	A-1, A-2, A-4	0-10	75-100	75-100	40-90	15-40	<20	NP-6
	40-44	Loamy sand-------	SM, SP-SM, SW-SM	A-1, A-2	0-10	75-100	75-100	40-90	10-25	---	NP
	44-60	Sand, gravelly sand.	SP, SM	A-1, A-2, A-3	0-10	55-100	55-100	30-95	1-15	---	NP
Pe*. Pits											
PfA, PfB, PfC, PfD---------- Plainfield	0-7	Sand----------	SP-SM, SM, SP	A-3, A-2, A-1	0	75-100	75-100	40-80	3-35	---	NP
	7-36	Sand----------	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-70	1-15	---	NP
	36-60	Sand, fine sand, coarse sand.	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-90	1-15	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
PlB---------- Plainfield	0-7	Sand----------	SP, SP-SM, SM	A-3, A-2, A-1	0	75-100	75-100	40-80	3-35	---	NP
	7-52	Sand----------	SP, SP-SM, SM	A-2, A-3, A-1	0	75-100	75-100	40-70	1-15	---	NP
	52-60	Loam, sandy loam, silt loam.	CL, SC, ML, SM	A-4, A-6	0-5	85-100	80-95	60-90	35-80	25-40	7-16
PmA---------- Plainfield	0-7	Sand----------	SP-SM, SM, SP	A-3, A-2-4, A-1-b	0	75-100	75-100	40-80	3-35	---	NP
	7-53	Sand----------	SP, SP-SM, SM	A-3, A-1-b, A-2-4	0	75-100	75-100	40-70	1-15	---	NP
	53-60	Sand, fine sand	SP, SP-SM, SM	A-3, A-1, A-2	0	75-100	75-100	40-90	1-15	---	NP
Pt---------- Poy	0-12	Clay----------	CL, CH	A-7	0	100	100	90-100	70-100	45-65	20-40
	12-29	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	70-100	40-90	20-60
	29-60	Sand, fine sand	SM, SP-SM, ML, SP	A-2, A-3, A-4	0	80-100	75-100	50-100	4-60	---	NP
Py---------- Poygan	0-11	Silty clay loam	CL, CH	A-7	0	100	100	90-100	75-95	45-55	25-35
	11-32	Silty clay, silty clay loam, clay.	CL, CH	A-7	0-5	90-100	80-100	80-100	65-95	45-80	25-45
	32-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0-5	90-100	85-100	80-100	65-95	40-70	20-45
RfA, RfB, RfC, RfD---------- Richford	0-8	Loamy sand-------	SM	A-2, A-4, A-1	0-5	75-100	75-100	40-90	12-40	---	NP
	8-26	Loamy sand, sand	SM, SP-SM, SP	A-1, A-2, A-3	0-5	75-100	75-100	40-90	3-30	---	NP
	26-33	Sandy loam-------	SM, SM-SC, ML, CL-ML	A-2, A-4	0-10	75-100	75-100	50-90	15-55	<25	2-6
	33-49	Loamy sand-------	SM	A-1, A-2	0-10	75-100	75-100	40-90	12-30	---	NP
	49-60	Sand, gravelly sand.	SP, SP-SM, SM	A-1, A-2, A-3	0-10	55-100	55-100	30-95	1-15	---	NP
SaB---------- Salter	0-7	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-100	65-95	<25	NP-7
	7-36	Very fine sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4, A-6	0	100	100	50-100	20-85	19-33	3-11
	36-60	Stratified silt to very fine sand.	SM, SC, ML, CL	A-4	0	100	100	80-100	40-85	19-28	2-9
Sp---------- Sparta	0-18	Loamy sand-------	SM	A-2, A-4	0	85-100	85-100	50-95	15-50	---	NP
	18-27	Loamy sand, sand	SP-SM, SM	A-2, A-3, A-4	0	85-100	85-100	50-95	5-50	---	NP
	27-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
SwA---------- Symco	0-17	Loamy fine sand	SM, SM-SC	A-2	0-15	85-100	85-100	50-85	15-35	<20	NP-5
	17-30	Clay loam, loam, silty clay loam.	CL	A-4, A-6, A-7	0-15	85-100	85-100	75-100	50-85	26-46	9-27
	30-60	Clay loam, loam	CL	A-4, A-6	0-15	85-100	85-100	75-100	50-85	20-40	7-18

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SyA---------- Symco	0-8	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0-15	85-100	85-100	85-100	60-90	20-35	3-15
	8-28	Clay loam, loam, silty clay loam.	CL	A-4, A-6, A-7	0-15	85-100	85-100	75-100	50-85	26-46	9-27
	28-60	Clay loam, loam	CL	A-4, A-6	0-15	85-100	85-100	75-100	50-85	20-40	7-18
TuB---------- Tustin	0-9	Loamy sand-------	SM	A-2	0	100	100	60-100	15-25	---	NP
	9-26	Loamy sand, sand	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	---	NP
	26-30	Sandy clay loam, loam, sandy loam.	SC, CL	A-6, A-4	0-5	90-100	90-100	80-90	45-55	20-30	7-13
	30-60	Silty clay, silty clay loam, clay.	CL, CH	A-7	0-5	90-100	90-100	85-100	65-100	40-80	20-50
Wm---------- Willette	0-31	Sapric material	PT	---	---	---	---	---	---	---	---
	31-60	Silty clay, clay	CL, CH	A-7	0	100	95-100	90-100	85-95	45-60	25-34
YaA---------- Yahara	0-8	Very fine sandy loam.	ML, SM	A-4	0	95-100	95-100	65-100	40-90	<20	NP-4
	8-32	Very fine sandy loam, loam, silt loam.	ML, CL, CL-ML	A-4	0	95-100	95-100	80-100	50-95	20-30	3-10
	32-60	Stratified very fine sand to silt loam.	ML, SM	A-4	0	95-100	95-100	80-100	40-95	---	NP
ZtA---------- Zittau	0-9	Clay----------	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-65	15-40
	9-23	Silty clay, clay	CH, CL	A-7	0	100	100	95-100	90-100	40-90	20-60
	23-60	Sand, fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3, A-4	0	85-100	85-100	60-100	4-50	---	NP
ZvA---------- Zittau Variant	0-8	Clay----------	CL, CH	A-7	0	100	100	90-100	90-100	40-90	20-60
	8-22	Clay, clay loam	CL, CH	A-7	0	100	100	95-100	90-100	40-90	20-60
	22-60	Silt loam--------	ML, CL, SM, SC	A-2, A-4, A-6	0	100	100	70-100	30-95	20-40	NP-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--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	0-32	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8			2	2	55-75
Adrian	32-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low				
Be	0-10	3-12	0.90-1.60	6.0-20	0.10-0.12	6.1-7.8	Low	0.17	5	2	.5-3
Belleville	10-30	2-12	1.45-1.70	6.0-20	0.06-0.10	6.1-8.4	Low	0.17			
	30-60	25-35	1.45-1.95	0.2-0.6	0.14-0.20	7.4-8.4	Moderate	0.32			
Bt	0-8	5-15	1.40-1.70	2.0-6.0	0.13-0.18	4.5-7.8	Low	0.20	4	3	1-2
Billett	8-28	6-18	1.40-1.70	2.0-6.0	0.10-0.17	4.5-7.3	Low	0.20			
	28-60	1-10	1.60-1.90	6.0-20	0.03-0.10	5.1-7.8	Low	0.10			
ByB, ByC	0-10	0-10	1.15-1.60	6.0-20	0.08-0.10	5.6-7.3	Low	0.17	4	2	.5-3
Boyer	10-22	10-18	1.25-1.60	2.0-6.0	0.11-0.13	5.6-7.8	Low	0.24			
	22-60	0-10	1.20-1.45	>20	0.02-0.04	7.4-8.4	Low	0.10			
BzD*:											
Boyer	0-10	0-10	1.15-1.60	6.0-20	0.08-0.10	5.6-7.3	Low	0.17	4	2	.5-3
	10-22	10-18	1.25-1.60	2.0-6.0	0.11-0.13	5.6-7.8	Low	0.24			
	22-60	0-10	1.20-1.45	>20	0.02-0.04	7.4-8.4	Low	0.10			
Mecosta	0-8	5-10	1.25-1.55	6.0-20	0.09-0.12	5.1-7.3	Low	0.10	5	8	.5-1
	8-15	5-12	1.25-1.60	6.0-20	0.06-0.10	5.1-7.8	Low	0.10			
	15-60	0-10	1.50-1.65	>20	0.02-0.06	6.6-8.4	Low	0.10			
CoB, CoC, CoD	0-4	2-10	1.35-1.65	6.0-20	0.08-0.12	4.5-7.3	Low	0.17	5	2	<1
Coloma	4-39	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low	0.15			
	39-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low	0.15			
FkA	0-8	3-12	1.40-1.70	6.0-20	0.09-0.14	5.1-7.3	Low	0.17	5	2	.5-2
Fisk	8-33	2-10	1.40-1.70	6.0-20	0.06-0.12	5.1-7.3	Low	0.17			
	33-36	10-18	1.55-1.65	0.6-2.0	0.12-0.19	6.1-7.8	Low	0.24			
	36-60	10-18	1.55-1.65	0.6-2.0	0.17-0.22	6.1-7.8	Low	0.37			
HnB	0-8	5-15	1.20-1.70	0.6-2.0	0.13-0.18	5.6-7.8	Low	0.24	4	3	1-3
Hortonville	8-35	23-35	1.50-1.70	0.2-0.6	0.12-0.19	5.6-7.8	Moderate	0.37			
	35-60	10-32	1.70-1.85	0.06-0.6	0.11-0.19	7.4-8.4	Moderate	0.37			
HrC2	0-6	10-18	1.20-1.65	0.6-2.0	0.16-0.24	5.6-7.8	Low	0.32	4	5	1-3
Hortonville	6-26	23-35	1.50-1.70	0.2-0.6	0.12-0.19	5.6-7.8	Moderate	0.37			
	26-60	10-32	1.70-1.85	0.06-0.6	0.11-0.19	7.4-8.4	Moderate	0.37			
Hu	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	4.5-7.8			2	2	>70
Houghton											
Hw	0-60	---	0.08-0.30	0.2-6.0	0.35-0.45	6.6-7.3			---	8	>70
Houghton											
Ke	0-13	10-20	1.30-1.45	0.6-2.0	0.20-0.24	6.6-8.4	Low	0.28	5	5	3-7
Keowns	13-29	10-18	1.55-1.65	0.6-2.0	0.12-0.22	7.4-8.4	Low	0.43			
	29-60	5-18	1.35-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low	0.15			
KnB	0-8	12-20	1.35-1.55	0.6-2.0	0.19-0.24	5.6-7.3	Low	0.32	3	5	1-3
Kewaunee	8-32	35-60	1.45-1.85	0.06-0.6	0.07-0.20	5.6-7.8	High	0.37			
	32-60	35-60	1.55-1.95	0.06-0.6	0.06-0.20	7.4-8.4	Moderate	0.37			

See footnote at end of table.

TABLE 17.--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
Ks	0-7	2-12	1.20-1.50	6.0-20	0.07-0.12	4.5-6.0	Low	0.17	5	2	3-6
Kingsville	7-15	2-12	1.20-1.50	6.0-20	0.07-0.12	4.5-6.5	Low	0.17			
	15-60	2-10	1.45-1.65	6.0-20	0.05-0.10	5.6-7.3	Low	0.17			
Le	0-8	4-10	1.35-1.65	2.0-6.0	0.08-0.12	4.5-7.3	Low	0.17	5	2	<2
Leola	8-31	4-10	1.35-1.65	2.0-6.0	0.09-0.11	4.5-7.3	Low	0.17			
	31-37	6-12	1.65-1.75	2.0-6.0	0.07-0.13	4.5-7.3	Low	0.17			
	37-44	2-12	1.75-1.90	2.0-20	0.07-0.10	4.5-7.3	Low	0.17			
	44-60	1-8	1.55-1.70	6.0-20	0.03-0.07	5.6-7.3	Low	0.17			
MbA	0-9	13-27	1.30-1.45	0.6-2.0	0.22-0.24	6.1-7.8	Low	0.37	3	5	4-9
Manawa	9-29	45-55	1.65-1.85	0.06-0.2	0.09-0.20	5.6-8.4	Moderate	0.28			
	29-60	35-60	1.85-1.95	0.06-0.2	0.08-0.20	7.4-8.4	Moderate	0.28			
MoA	0-8	4-10	1.35-1.65	6.0-20	0.10-0.12	3.6-6.0	Low	0.17	5	2	.5-3
Meehan	8-33	4-9	1.60-1.70	6.0-20	0.06-0.11	5.1-6.5	Low	0.17			
	33-60	1-4	1.60-1.70	6.0-20	0.02-0.07	5.1-6.5	Low	0.17			
MrA	0-8	1-6	1.45-1.65	6.0-20	0.07-0.09	5.1-6.5	Low	0.15	5	1	.5-2
Morocco	8-60	1-6	1.50-1.70	6.0-20	0.05-0.07	4.5-6.0	Low	0.15			
NeA	0-9	3-12	1.40-1.60	6.0-20	0.10-0.13	5.6-7.3	Low	0.17	4	2	.5-2
Nebago	9-24	2-12	1.40-1.60	6.0-20	0.06-0.11	5.6-7.3	Low	0.15			
	24-60	35-85	1.65-1.75	0.06-0.6	0.09-0.20	6.1-8.4	High	0.28			
OkB, OkC, OkD	0-6	4-10	1.55-1.70	2.0-6.0	0.07-0.13	5.6-7.3	Low	0.17	4	2	.5-2
Okee	6-23	2-10	1.50-1.65	0.6-6.0	0.05-0.12	5.6-7.3	Low	0.17			
	23-35	10-18	1.55-1.70	0.6-6.0	0.12-0.16	5.6-7.8	Low	0.32			
	35-42	4-15	1.55-1.65	0.6-6.0	0.09-0.11	5.6-7.8	Low	0.24			
	42-60	4-15	1.35-1.85	2.0-20	0.07-0.12	5.6-7.3	Low	0.17			
Pa	0-26	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	---	---	2	2	>75
Palms	26-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low	---			
PbA	0-8	2-8	1.35-1.65	2.0-6.0	0.10-0.12	4.5-7.3	Low	0.17	5	2	.5-2
Pearl	8-36	2-8	1.35-1.65	2.0-20	0.05-0.11	4.5-7.3	Low	0.17			
	36-40	6-12	1.40-1.70	2.0-6.0	0.07-0.13	4.5-7.3	Low	0.17			
	40-44	2-8	1.45-1.65	2.0-6.0	0.07-0.10	4.5-7.3	Low	0.17			
	44-60	1-5	1.55-1.70	6.0-20	0.03-0.07	4.5-7.3	Low	0.17			
Pe*.											
Pits											
PfA, PfB, PfC, PfD	0-7	2-5	1.50-1.65	6.0-20	0.04-0.09	5.1-7.3	Low	0.15	5	1	.5-2
Plainfield	7-36	0-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.5	Low	0.15			
	36-60	0-4	1.50-1.70	6.0-20	0.03-0.07	4.5-6.5	Low	0.15			
PlB	0-7	2-5	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low	0.15	5	1	<1
Plainfield	7-52	1-4	1.50-1.70	6.0-20	0.05-0.07	4.5-6.5	Low	0.17			
	52-60	15-27	1.60-1.70	0.6-2.0	0.13-0.18	5.1-8.4	Low	0.32			
PmA	0-7	2-5	1.50-1.65	6.0-20	0.07-0.09	4.5-7.3	Low	0.15	5	1	<1
Plainfield	7-53	0-4	1.50-1.70	6.0-20	0.04-0.08	4.5-6.5	Low	0.17			
	53-60	0-4	1.50-1.70	6.0-20	0.04-0.07	4.5-6.5	Low	0.17			
Pt	0-12	40-60	1.35-1.60	0.2-0.6	0.11-0.23	6.1-7.8	High	0.28	3	4	3-12
Poy	12-29	35-85	1.55-1.65	0.06-0.2	0.09-0.13	6.1-8.4	High	0.28			
	29-60	2-9	1.55-1.80	6.0-20	0.04-0.10	6.6-8.4	Low	0.15			

See footnote at end of table.

TABLE 17.--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
Py	0-11	27-45	1.35-1.65	0.2-0.6	0.11-0.23	6.1-7.8	Moderate	0.28	3	7	4-10
Poygan	11-32	35-60	1.65-1.75	0.06-0.2	0.09-0.18	6.1-7.8	High	0.28			
	32-60	35-60	1.85-1.95	0.06-0.2	0.08-0.20	7.4-8.4	High	0.28			
RfA, RfB, RfC, RfD	0-8	4-10	1.35-1.65	2.0-6.0	0.09-0.13	5.6-7.3	Low	0.17	5	2	<1
Richford	8-26	2-12	1.50-1.70	2.0-20	0.05-0.11	5.6-7.3	Low	0.17			
	26-33	6-12	1.55-1.70	2.0-6.0	0.10-0.17	5.1-7.3	Low	0.17			
	33-49	2-12	1.55-1.70	6.0-20	0.07-0.10	5.1-7.3	Low	0.17			
	49-60	1-5	1.65-1.80	6.0-20	0.03-0.07	6.1-7.3	Low	0.17			
SaB	0-7	5-14	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.8	Low	0.37	5	5	2-3
Salter	7-36	8-18	1.45-1.55	0.6-2.0	0.10-0.19	5.1-6.0	Low	0.20			
	36-60	8-18	1.55-1.65	0.6-2.0	0.14-0.16	5.1-5.5	Low	0.37			
Sp	0-18	3-10	1.20-1.40	2.0-6.0	0.09-0.12	5.1-7.3	Low	0.17	5	2	1-2
Sparta	18-27	1-8	1.40-1.60	6.0-20	0.05-0.11	5.1-7.3	Low	0.15			
	27-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-7.3	Low	0.15			
SwA	0-17	3-10	1.40-1.60	6.0-20	0.10-0.12	6.6-7.8	Low	0.17	5	2	1-2
Symco	17-30	18-30	1.55-1.65	0.2-0.6	0.11-0.20	6.1-8.4	Moderate	0.32			
	30-60	15-30	1.65-1.80	0.2-0.6	0.10-0.20	7.4-8.4	Low	0.32			
SyA	0-8	10-25	1.35-1.55	0.6-2.0	0.15-0.24	6.6-7.8	Low	0.28	5	5	3-7
Symco	8-28	18-30	1.55-1.65	0.2-0.6	0.11-0.20	6.1-8.4	Moderate	0.32			
	28-60	15-30	1.65-1.80	0.2-0.6	0.10-0.20	7.4-8.4	Low	0.32			
TuB	0-9	4-10	1.55-1.70	6.0-20	0.09-0.13	5.1-7.3	Low	0.17	4	2	.5-2
Tustin	9-26	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-7.3	Low	0.17			
	26-30	15-25	1.40-1.70	0.6-2.0	0.11-0.19	5.6-7.3	Low	0.24			
	30-60	35-60	1.45-1.55	0.06-0.2	0.07-0.20	5.6-8.4	High	0.43			
Wm	0-31	---	0.25-0.45	0.2-6.0	0.35-0.45	6.1-7.8	----------	----	2	2	>60
Willette	31-60	40-60	1.40-1.65	0.06-0.2	0.12-0.16	7.4-8.4	High	----			
YaA	0-8	5-18	1.20-1.65	0.6-2.0	0.16-0.22	6.1-7.8	Low	0.28	5	3	2-4
Yahara	8-32	10-18	1.55-1.65	0.6-2.0	0.17-0.22	6.1-7.8	Low	0.43			
	32-60	4-12	1.55-1.65	0.6-2.0	0.14-0.16	7.4-8.4	Low	0.43			
ZtA	0-9	27-60	1.35-1.60	0.2-0.6	0.12-0.23	5.6-7.3	Moderate	0.32	3	4	3-5
Zittau	9-23	40-85	1.35-1.55	0.06-0.2	0.09-0.13	5.6-8.4	High	0.28			
	23-60	2-10	1.55-1.70	6.0-20	0.04-0.10	6.6-8.4	Low	0.15			
ZvA	0-8	40-70	1.35-1.60	0.2-0.6	0.12-0.23	6.1-7.3	Moderate	0.28	3	4	3-5
Zittau Variant	8-22	35-75	1.55-1.65	0.06-0.2	0.09-0.13	6.6-7.3	High	0.28			
	22-60	5-20	1.25-1.55	0.6-2.0	0.14-0.22	7.4-8.4	Low	0.43			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Water table" and terms such as "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	High water table			Total subsidence	Potential frost action	Risk of corrosion	
		Depth	Kind	Months			Uncoated steel	Concrete
		Ft			In			
Ad---------- Adrian	A/D	+1-1.0	Apparent	Nov-May	29-33	High-----	High-----	Moderate.
Be---------- Belleville	B/D	+1-1.0	Apparent	Nov-May	---	High-----	High-----	Low.
Bt---------- Billett	B	>6.0	---	---	---	Moderate	Low------	Moderate.
ByB, ByC---- Boyer	B	>6.0	---	---	---	Low------	Low------	Moderate.
BzD*:								
Boyer-------	B	>6.0	---	---	---	Low------	Low------	Moderate.
Mecosta-----	A	>6.0	---	---	---	Low------	Low------	Moderate.
CoB, CoC, CoD--- Coloma	A	>6.0	---	---	---	Low------	Low------	Moderate.
FkA---------- Fisk	B	1.0-3.0	Apparent	Nov-Jun	---	High-----	High-----	Moderate.
HnB, HrC2---- Hortonville	B	>6.0	---	---	---	Moderate	Low------	Moderate.
Hu---------- Houghton	A/D	+1-1.0	Apparent	Sep-Jun	55-60	High-----	High-----	Moderate.
Hw---------- Houghton	D	+3-0.5	Apparent	Sep-Jun	40-60	High-----	High-----	Low.
Ke---------- Keowns	B/D	+1-1.0	Apparent	Oct-May	---	High-----	High-----	Low.
KnB---------- Kewaunee	C	>6.0	---	---	---	Moderate	High-----	Low.
Ks---------- Kingsville	A/D	+1-1.0	Apparent	Jan-Apr	---	Moderate	High-----	High.
Le---------- Leola	B	1.5-3.0	Apparent	Nov-Apr	---	Moderate	Low------	Moderate.
MbA---------- Manawa	C	1.0-3.0	Perched	Nov-Jun	---	High-----	High-----	Low.
MoA---------- Meehan	B	1.0-3.0	Apparent	Oct-May	---	Moderate	Low------	Moderate.
MrA---------- Morocco	B	1.0-2.0	Apparent	Jan-Apr	---	Moderate	Low------	High.
NeA---------- Nebago	C	1.0-3.0	Perched	Nov-May	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	High water table			Total subsidence	Potential frost action	Risk of corrosion	
		Depth	Kind	Months			Uncoated steel	Concrete
		Ft			In			
OkB, OkC, OkD--- Okee	B	>6.0	---	---	---	Low------	Moderate	Moderate.
Pa---------- Palms	A/D	+1-1.0	Apparent	Nov-May	25-32	High-----	High-----	Moderate.
PbA---------- Pearl	B	2.5-5.0	Apparent	Nov-May	---	Low------	Low------	Moderate.
Pe*. Pits								
PfA, PfB, PfC, PfD---------- Plainfield	A	>6.0	---	---	---	Low------	Low------	High.
PlB---------- Plainfield	A	>6.0	---	---	---	Low------	Low------	Moderate.
PmA---------- Plainfield	A	4.0-6.0	Apparent	Dec-Jun	---	Low------	Low------	High.
Pt---------- Poy	D	+1-1.0	Perched	Nov-May	---	High-----	High-----	Low.
Py---------- Poygan	D	+1-1.0	Perched	Nov-Jul	---	High-----	High-----	Low.
RfA, RfB, RfC, RfD---------- Richford	A	>6.0	---	---	---	Low------	Low------	Moderate.
SaB---------- Salter	B	3.0-6.0	Apparent	Mar-May	---	Moderate	Low------	Moderate.
Sp---------- Sparta	A	>6.0	---	---	---	Low------	Low------	Moderate.
SwA, SyA-------- Symco	C	1.0-3.0	Apparent	Nov-May	---	High-----	Moderate	Low.
TuB---------- Tustin	B	>6.0	---	---	---	Moderate	High-----	Low.
Wm---------- Willette	A/D	+1-1.0	Perched	Nov-May	25-32	High-----	High-----	Low.
YaA---------- Yahara	C	1.0-3.0	Apparent	Nov-May	---	High-----	Moderate	Low.
ZtA---------- Zittau	C	1.0-3.0	Apparent	Nov-May	---	High-----	High-----	Low.
ZvA---------- Zittau Variant	D	1.0-3.0	Apparent	Nov-Jun	---	High-----	High-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Belleville	Sandy over loamy, mixed, mesic Typic Haplaquolls
Billett	Coarse-loamy, mixed, mesic Mollic Hapludalfs
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Coloma	Mixed, mesic Alfic Udipsamments
Fisk	Sandy over loamy, mixed, mesic Aquic Dystric Eutrochrepts
Hortonville	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Houghton	Euic, mesic Typic Medisaprists
*Keowns	Coarse-loamy, mixed, nonacid, mesic Mollic Haplaquepts
Kewaunee	Fine, mixed, mesic Typic Hapludalfs
Kingsville	Mixed, mesic Mollic Psammaquents
Leola	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Manawa	Fine, mixed, mesic Aquollic Hapludalfs
Mecosta	Sandy-skeletal, mixed, mesic Typic Udorthents
Meehan	Mixed, frigid Aquic Udipsamments
Morocco	Mixed, mesic Aquic Udipsamments
Nebago	Sandy over clayey, mixed, mesic Aquic Dystric Eutrochrepts
Okee	Loamy, mixed, mesic Arenic Hapludalfs
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Pearl	Sandy, mixed, mesic Psammentic Hapludalfs
Plainfield	Mixed, mesic Typic Udipsamments
Poy	Clayey over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Poygan	Fine, mixed, mesic Typic Haplaquolls
Richford	Sandy, mixed, mesic Psammentic Hapludalfs
Salter	Coarse-loamy, mixed, mesic Typic Eutrochrepts
Sparta	Sandy, mixed, mesic Entic Hapludolls
Symco	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Tustin	Clayey, mixed, mesic Arenic Hapludalfs
Willette	Clayey, illitic, euic, mesic Terric Medisaprists
*Yahara	Coarse-loamy, mixed, mesic Aquic Hapludolls
*Zittau	Clayey over sandy or sandy-skeletal, mixed, mesic Aquollic Hapludalfs
Zittau Variant	Clayey over loamy, mixed, mesic Aquic Argiudolls

*U.S. G.P.O. 1990-256-639

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