SOIL SURVEY OF

Eau Claire County, Wisconsin

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

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1967–73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1974. 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 Eau Claire County Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SURVEY contains information that can be applied in managing farms, woodlands, and wildlife areas; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Eau Claire County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the capability unit, woodland suitability group, wildlife group, recreation group, and tree and shrub group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and woodland suitability groups.

Foresters and others can refer to the section "Use of the Soils for Woodland," where the soils of the county are grouped according to their suitability for trees.

Wildlife managers and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife Habitat."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Use of the Soils for Recreational Development."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about the soils in the section "Formation and Classification of the Soils."

Newcomers in the area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "Environmental Factors Affecting Soil Use."

Cover: Typical conservation farming west of City of Eau Claire. Extensively developed urban areas are in hilly woodland in background.

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SOIL SURVEY OF EAU CLAIRE COUNTY, WISCONSIN

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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

EAU CLAIRE COUNTY is in the west-central part of Wisconsin (fig. 1). It is bordered on the south by Trempealeau, Buffalo, and Jackson Counties; on the west by Dunn and Pepin Counties; on the north by Chippewa County; and on the east by Clark County. The county extends about 36 miles from east to west and about 18 miles from north to south. The total number of acres of land in the county is about 414,272. Thirteen civil townships are in the county. The city of Eau Claire, the county seat, is in the northwestern part of the county at the confluence of the Eau Claire and Chippewa Rivers.

The name Eau Claire was taken from the name of the main tributary of the Chippewa River within the county. It is the French interpretation of the Indian name for clear water.

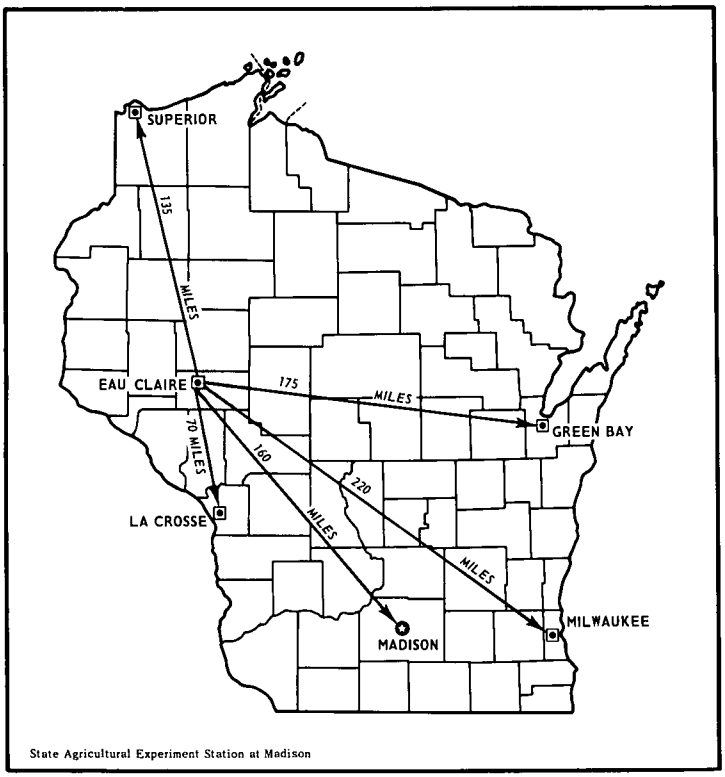

***Figure 1.*— Location of Eau Claire County in Wisconsin.**

When Eau Claire County was created by an act of the State legislature in October 1856, the lumbering industry was in its initial stages. The northern and eastern parts of the county were covered with pine forests. Small lumbering operations began in the 1840's and reached their peak in the 1880's. At one time there were 15 sawmills in the city of Eau Claire. The cities of Eau Claire, Augusta, and Fairchild were settled as a result of the establishment of sawmills and the development of lumbering.

Farm settlement in Eau Claire County began in the middle of the nineteenth century and then developed along with the lumbering industry. The lumber camps furnished the farmers with markets for their products and made it possible to change from subsistence farming to production for markets. The growing of wheat, oats, and barley was the main source of farm income until the late 1800's when dairy products became very important. The establishment of creameries and the development of mechanical cream separators helped to stabilize and maintain this industry. In the early 1940's, mechanization triggered an increase in farm size and reduced the need for farm workers. The shift in population from farms to cities began at this time and is still continuing. Today Eau Claire County has two kinds of farms: the large farm with a full time operator and the small farm operated on a part time basis by an individual gaining part of his income from sources other than farm products.

In Eau Claire County, as is the general trend throughout the United States, the number of farms is decreasing and the average size per farm is increasing. There is also an increase in part time farmers and small hobby farms. Many areas that have sandy soils or soils with low available water capacity are no longer farmed and are planted to pine trees. An increasing amount of rural land is being used for nonfarm homes, summer cottages, and camping and recreational areas. Attractive lakes, streams, and wetlands make Eau Claire County a favorable destination for

[1] JOSEPH M. BOELTER, DALE C. JAKEL, and DAVID A. MEDIN also mapped for a short period.

vacationers and urban residents seeking a rural retreat. Areas near the many lakes and streams are becoming increasingly important as homesites and recreational areas. Wooded tracts throughout the county are also in demand for these uses. As a result, local and state ordinances involving land use zoning are becoming more important in protecting the soil and water resources from indiscriminate land development and water pollution. Public awareness of the need for this protection will grow as the population increases.

The soils of Eau Claire County are mainly shallow to deep, loamy ones that are underlain by sandstone at a depth of 10 inches to more than 10 feet. Glacial till mantles the sandstone in places. Extensive areas of sandy soils are along the major streams and in the eastern part of the county. Sandy and loamy soils, some of which are wet, are on broad flats and along small streams throughout the county.

Corn, oats, and alfalfa are the major crops, but truck crops and canning crops are grown in some areas. Wooded areas are on steep, sandy soils and on wet soils in low areas. Much of the farm income comes from dairying and from livestock and livestock products.

The city of Eau Claire and the developing fringe areas make up most of the northwestern part of the county. The Chippewa and Eau Claire Rivers and the county owned forest in the eastern part of the county are areas of recreational development which are expanding. The increasing demand for sites for homes, industries, and recreational facilities makes it important to select areas of suitable soils for the intended use. This survey, therefore, is designed to provide information useful for community and county planning as well as for farming purposes.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Eau Claire County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size of streams; the kinds of native plants or crops; the kinds of rock; and many other facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have a profile almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other important feature near the place where a soil of that series was first observed and mapped. Gale and Seaton, for example, are the names of two soils series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Seaton silt loam, 6 to 12 percent, eroded, is one of several phases within the Seaton series.

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

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series or of different phases within one series. Two such kind of mapping units—soil complexes and undifferentiated groups—are shown on the soil map of Eau Claire County.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils joined by a hyphen. Boone-Plainbo complex, 2 to 6 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils joined by "and." Ludington and Humbird soils, 2 to 6 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are

given descriptive names, such as "Alluvial land, sandy," which is a land type in Eau Claire County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

A map showing soil associations is useful to people who want to have a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for broad planning of a watershed, a wooded tract, or a wildlife area or for broad planning of recreational facilities, community developments, and such engineering works as transportation corridors. It is not a suitable map for detailed planning for management of a farm or field or for selecting the exact location of a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

Soil associations and delineations on the general soil map for this county do not fully agree with those of the general soil maps in adjacent counties published at a different date. Differences in the maps are the result of improvement in the classification of soils, particularly modifications or refinements in soil series concepts. In addition, more precise and detailed maps are now needed because the uses of the general soil maps have expanded in recent years. The more recent maps meet this need. Still another difference is the pattern of occurrence of the major soils or the range in scope that is permitted within associations in different surveys. One such difference is in the general soil map of the published soil survey of Dunn County which shows an area of Alluvial land, wet, and Boaz soils extending to the Eau Claire County line. Boaz soils are not present in Eau Claire County, however, and the areas of Alluvial land, wet, in Eau Claire County are too small to be shown on the general map.

The seven soil associations in Eau Claire County are discussed in the paragraphs that follow.

1. Elkmound-Eleva Association

Well drained and somewhat excessively drained loams and sandy loams that are underlain by loamy and sandy material and sandstone; on uplands

This association consists of gently sloping to very steep ridges and valleys that have well defined stream and drainageway patterns. The ridgetops typically range from 50 to 200 feet above the valley floors. Steep and very steep areas have mostly short slopes, and other areas typically have medium slopes.

This association makes up about 19 percent of the county. It is 42 percent Elkmound soils, 16 percent Eleva soils, and 42 percent minor soils.

Elkmound soils are gently sloping to very steep and are well drained. These soils are on ridgetops and side slopes in the higher and steeper areas of the county. The surface layer typically is dark grayish brown loam about 8 inches thick. The subsoil is yellowish brown loam about 4 inches thick. Partly weathered platy sandstone is at a depth of about 16 inches.

Eleva soils are gently sloping to moderately steep and are well drained or somewhat excessively drained. These soils are on ridgetops and hillsides in smoother areas, generally slightly below nearby Elkmound soils. The surface layer typically is very dark grayish brown sandy loam about 7 inches thick. The subsoil is about 18 inches thick. It is brown loam in the upper part and yellowish brown sandy loam in the lower part. Below the subsoil is 15 inches of sand and soft sandstone underlain by 45 inches or more of hard sandstone.

Among the minor soils in this association are those of the Billett, Boone, Northfield, Plainbo, and Plainfield series. The well drained and moderately well drained Billett soils and the excessively drained Plainfield soils are at the bases of slopes near areas of Eleva soils. The well drained Northfield soils are on tops and sides of ridges mainly near Elkmound soils. The excessively drained Boone and Plainbo soils are throughout this association on sandy knolls and ridges.

Controlling erosion and maintaining tilth and fertility are the main concerns in managing the major soils for cultivation.

Most areas of this association are used for such cultivated crops as corn, soybeans, small grain, and hay. Steeper areas, however, are used for pasture, woodland, or wildlife habitat. The main farm enterprises

are growing cash crops, dairying, and raising beef cattle. The major soils in this association have moderate potential for crops commonly grown in the county.

The major soils in this association are shallow or moderately deep to sandstone bedrock, and many are sloping to steep; thus, they have moderate or severe limitations for homesites, septic tank absorption fields, local roads and streets, and sanitary landfills.

2. Seaton-Gale-Urne Association

Well drained and somewhat excessively drained silt loams and very fine sandy loams that are underlain by loamy and sandy material and sandstone; on uplands

This association consists of nearly level to very steep ridges and valleys that have well established drainage patterns (fig. 2). The ridgetops are narrow, mostly less than one-quarter of a mile in width. Most of the valleys are long and are narrow at the heads, but widen to as much as three-quarters of a mile at the valley outlets. The ridgetops are mainly 200 to 400 feet above the valley floors. Gently sloping areas have medium slopes, and steep areas have mostly short slopes.

This association makes up about 15 percent of the county. It is about 40 percent Seaton soils, 24 percent Gale soils, 9 percent Urne soils, and 27 percent minor soils.

Seaton soils are nearly level to steep and are mostly well drained. In some areas Seaton soils are moderately well drained. These soils are on ridgetops and side slopes along with Gale soils in the smoother areas of the county. Seaton soils are at a lower elevation than nearby Urne soils. The surface layer typically is dark grayish brown silt loam about 8 inches thick. The subsoil is yellowish brown and dark yellowish brown silt loam and heavy silt loam about 32 inches thick. Below the subsoil to a depth of about 60 inches is yellowish brown silt loam.

Gale soils are gently sloping to steep and are well drained. These soils are on ridgetops and side slopes along with Seaton soils in the smoother areas of the county. The ridges on which Gale soils occur are mostly narrower and more sharply defined than those on which Seaton soils occur. The surface layer typically is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 24 inches thick. It is brown and dark yellowish brown silt loam in the

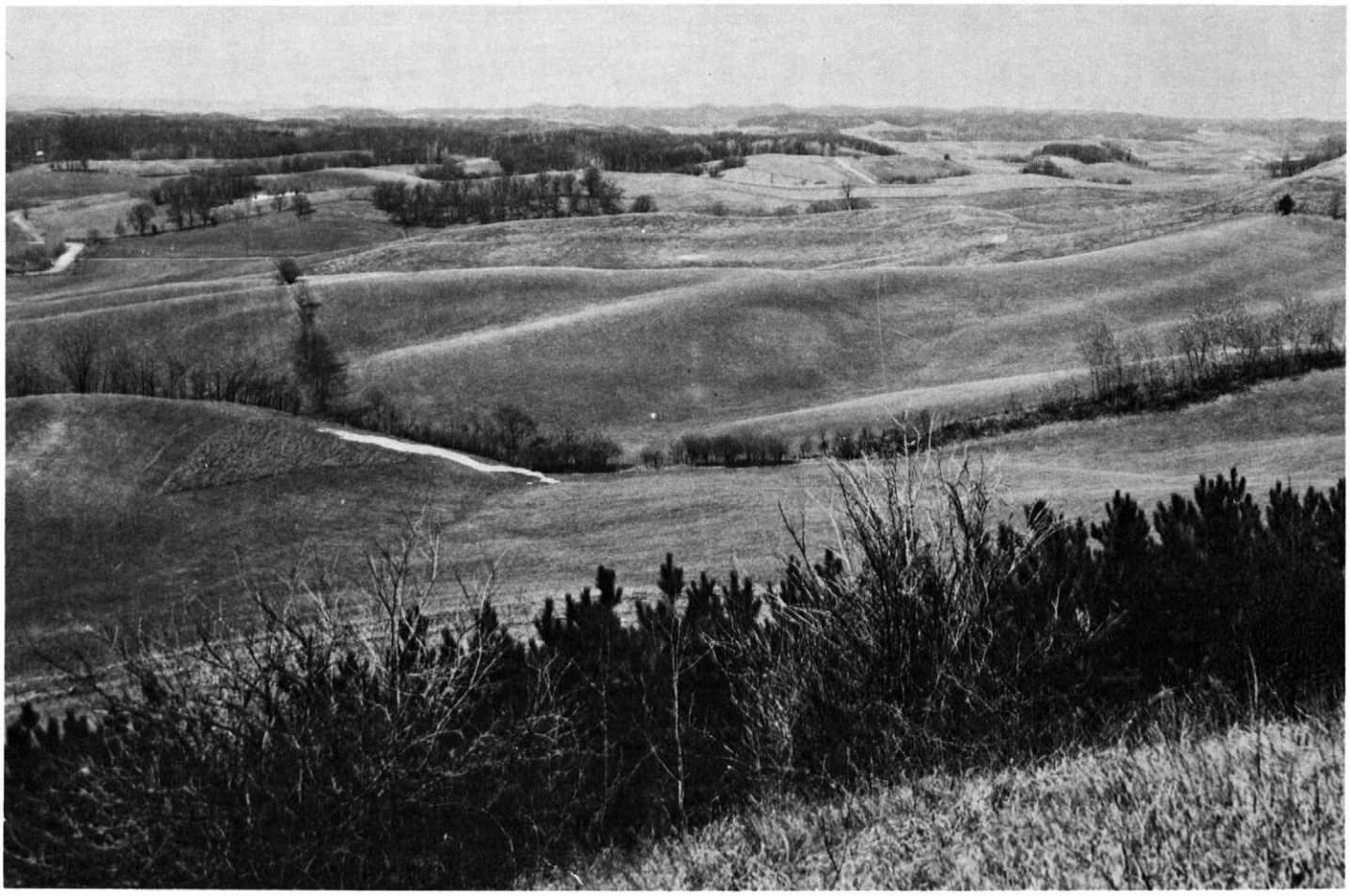

***Figure 2.*—Typical landscape of Seaton, Gale, and Urne soils in soil association 2. Areas where slopes are steep are kept in hay or pasture plants.**

upper part and yellowish brown loam in the lower part. The substratum, to a depth of about 60 inches, is 10 inches of light gray, pale brown, and yellow sand and weakly cemented sandstone underlain by hard sandstone.

Urne soils are moderately steep to very steep and are somewhat excessively drained. These soils are on side slopes of long, narrow ridges in the steeper and higher areas of the county. The surface layer typically is dark grayish brown very fine sandy loam about 6 inches thick. The subsoil is olive very fine sandy loam about 18 inches thick. The substratum, to a depth of about 60 inches, is olive and greenish gray sandstone.

Among the minor soils in this association are those of the Arenzville, Mt. Carroll, Norden, and Northfield series. Northfield and Norden soils are on ridgetops and sides of ridges along with Urne and Gale soils. Small areas of Mt. Carroll soils are intermingled with valley areas of Seaton soils at the base of the ridges. Arenzville soils are in valley bottoms along small streams and drainageways.

Controlling erosion and maintaining tilth and fertility are the main concerns in managing the major soils for cultivation.

In most areas, soils of this association are used for such cultivated crops as corn, soybeans, small grain, and hay. Steeper soils, however, are used for pasture, woodland, or wildlife habitat. The main farm enterprises are dairying and raising beef cattle. The major soils in this association have high potential for crops commonly grown in the county.

The major soils in this association have moderate or severe limitations for homesites, septic tank absorption fields, and local roads and streets. Urne and Gale soils have severe limitations for sanitary landfills, nearly level to sloping Seaton soils have slight limitations for sanitary landfills, and moderately steep to steep Seaton soils have moderate limitations for sanitary landfills.

3. Menahga-Plainfield Association

Excessively drained sands and loamy sands that are underlain by loamy sand and sand; on stream terraces

This association consists of broad, nearly level and gently sloping glacial outwash plains and stream terraces. In places there are small sloping areas mounded by winds or dissected by streams. Most nearly level to gently sloping areas have long slopes, and sloping areas have short slopes.

This association makes up about 31 percent of the county. It is about 34 percent Menahga soils, 28 percent Plainfield soils, and 38 percent minor soils.

Menahga soils are nearly level to sloping and are excessively drained. These soils are on broad stream terraces and outwash plains. The surface layer and subsurface layer typically are very dark grayish brown and dark grayish brown sand about 5 inches thick. The subsoil is yellowish brown and dark yellowish brown sand about 19 inches thick. The substratum, to a depth of about 60 inches, is pale brown and very pale brown sand.

Plainfield soils are nearly level to sloping and are excessively drained. These soils are on similar landforms as the Menahga soils, but they also extend into the narrower valleys. The surface layer typically is dark grayish brown loamy sand about 6 inches thick. The subsoil is about 23 inches thick. It is dark brown loamy sand in the upper part and dark yellowish brown sand in the lower part. The substratum, to a depth of about 60 inches, is yellowish brown and light yellowish brown sand.

Among the minor soils in this association are those of the Caryville, Friendship, Markey, Morocco, and Newson series and the Whitehall variant. Alluvial land, sandy; Alluvial land, wet; and Terrace escarpments, sandy, are land types in this association.

Terrace escarpments, sandy, are in long, narrow, moderately steep to very steep breaks at the edges of stream terraces. Alluvial land, wet, and Alluvial land, sandy, are in narrow strips along streams. The moderately well drained Friendship soils and the wet Morocco, Newson, and Markey soils are on flats or in depressions on sand plains. The well drained Caryville and Whitehall variant soils are on broad, nearly level and gently sloping stream bottoms and low stream terraces.

Controlling erosion and soil blowing and maintaining organic matter content and fertility are the main concerns in managing the major soils for cultivation. Unless irrigated, however, the major soils in this association have low potential for cultivated crops.

Most of this association is wooded and used for recreation. A small acreage of corn, soybeans, small grain, and hay are grown mainly in the western and southern parts of this association. Many areas that were farmed in previous years are now idle or are planted to pine trees. In places sand and gravel are mined from Caryville soils. The Whitehall variant is an important source of lawn topsoil for the nearby city of Eau Claire.

The cities of Eau Claire and Altoona and other urban areas (fig. 3) are in this association. Campgrounds, lake cottages, rural residences, snowmobile trails, and hunting and fishing facilities are common.

The major soils in this association have slight limitations for homesites and local roads and streets. They also have slight limitations for septic tank absorption fields, but there is danger of contaminating nearby water supplies. They have severe limitations for sanitary landfills.

4. Seaton-Curran-Tell Association

Well drained to somewhat poorly drained silt loams that are underlain by silt loam, loam, stratified silt and fine sand or sand; on stream terraces

This association consists of nearly level to sloping stream terraces on the larger flood plains and in the narrower valleys between the surrounding uplands. Most nearly level to sloping areas have long slopes.

This association makes up about 6 percent of the county. It is about 38 percent Seaton soils, 12 percent Curran soils, 9 percent Tell soils, and 41 percent minor soils.

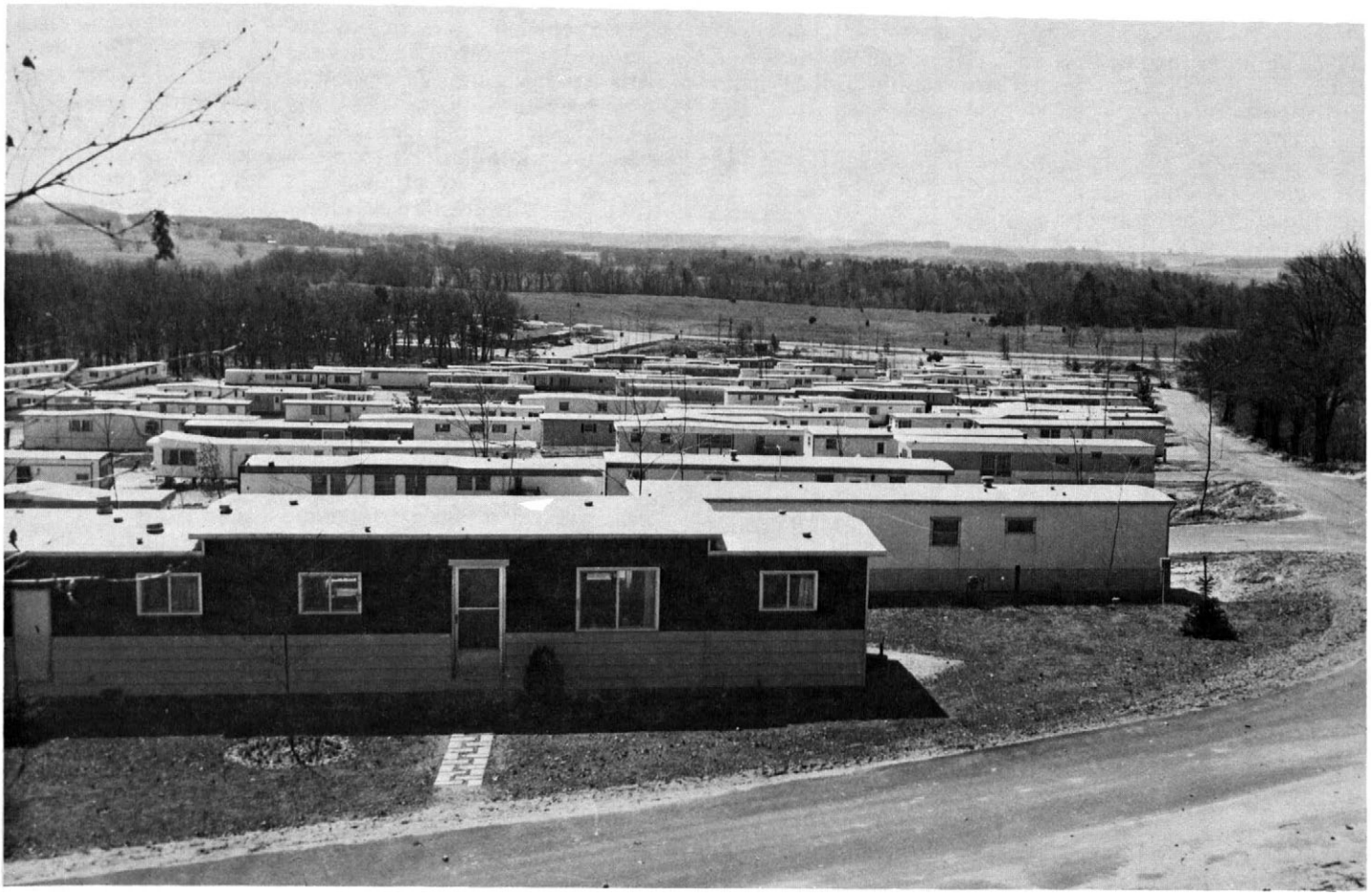

Figure 3.—**Large park for mobile homes on sandy soils east of the city of Eau Claire, Menahga-Plainfield association (association 3).**

Seaton soils are nearly level and gently sloping and are mostly well drained. In some areas, however, these soils are moderately well drained. Most areas of these soils are on the higher parts of stream terraces adjacent to the uplands. The surface layer typically is dark grayish brown silt loam about 8 inches thick. The subsoil is dark yellowish brown and yellowish brown silt loam and heavy silt loam about 32 inches thick. In places the lower part of the subsoil is mottled. The substratum, to a depth of about 60 inches, is yellowish brown silt loam.

Curran soils are nearly level and somewhat poorly drained. These soils are in slight depressions on broad stream terraces. The surface layer and subsurface layer typically are very dark grayish brown and dark grayish brown silt loam about 11 inches thick. The subsoil is about 49 inches thick. It is dark brown, brown, and grayish brown, mottled silt loam and very heavy silt loam. The substratum, to a depth of about 72 inches, is grayish brown, mottled strata of medium and fine sand.

Tell soils are nearly level and gently sloping and are well drained. Most areas of these soils are on the higher parts of stream terraces adjacent to the uplands. The surface layer and subsurface layer are typically dark grayish brown and brown silt loam about 10 inches thick. The subsoil is about 24 inches thick. It is yellowish brown silt loam in the upper part, dark yellowish brown heavy silt loam in the middle, and dark brown loam in the lower part. The substratum, to a depth of about 60 inches, is yellowish brown sand.

Among the minor soils in this association are those of the Dells, Ettrick, Mt. Carroll, and Otter series. Otter and Ettrick soils are in low, wet areas along streams. The nearly level, somewhat poorly drained Dells soils are intermingled with Curran soils. The nearly level Mt. Carroll silt loam, benches, is in areas adjacent to Seaton silt loam, benches.

Controlling erosion, improving drainage, and maintaining tilth and fertility are the main concerns in managing the major soils for cultivation.

Most areas of this association are used for such cultivated crops as corn, soybeans, small grain, and hay and for such specialty crops as snap beans, peas, and sweet corn. In places areas of wet soils are used for pasture or wildlife habitat. The main farm enterprises are growing cash crops, dairying, and raising beef cattle. The major soils in this association have high potential for all crops commonly grown in the county.

Curran soils have severe limitations for homesites, septic tank absorption fields, and sanitary landfills. They have moderate limitations for local roads and streets. Seaton soils have moderate limitations for

homesites, septic tank absorption fields, and local roads and streets if slopes are less than 12 percent and severe limitations for these uses if slopes are more than 12 percent. They have slight limitations for sanitary landfills if slopes are less than 12 percent and moderate limitations for this use if slopes are more than 12 percent. Tell soils have slight limitations for homesites and septic tank absorption fields, moderate limitations for local roads and streets, and severe limitations for sanitary landfills.

5. Fallcreek-Cable Association

Somewhat poorly drained and poorly drained sandy loams and loams that are underlain by loamy material and sandy loam or loam glacial till; on glacial uplands

This association consists of nearly level and gently sloping glacial till plains on knolls and low ridges and in wet depressions between the ridges. Nearly level and gently sloping areas have long slopes.

This association makes up about 5 percent of the county. It is about 36 percent Fallcreek soils, 24 percent Cable soils, and 40 percent minor soils.

Fallcreek soils are nearly level and gently sloping. They are somewhat poorly drained. These soils are on smooth glacial till plains, mainly in long, gently sloping areas or in slight depressions. The surface layer typically is dark grayish brown sandy loam about 8 inches thick. The subsurface layer is brown and grayish brown sandy loam about 8 inches thick. The subsoil is about 26 inches thick. It is pale brown loam in the upper part, reddish brown heavy loam in the middle, and reddish brown light loam in the lower part. The subsoil is mottled and has few to many pebbles. The substratum, to a depth of about 60 inches, is reddish brown, mottled loam that has few to many pebbles.

Cable soils are nearly level, and they are poorly drained. These soils are in swales and depressions on glacial till plains at a slightly lower elevation than nearby Fallcreek soils. The surface layer typically is very dark gray loam about 5 inches thick. The subsurface layer is about 10 inches thick. It is dark gray loam in the upper part and gray sandy loam in the lower part. The subsoil is about 27 inches thick. It is gray and brown light loam and sandy loam that is mottled throughout. The substratum, to a depth of about 60 inches, is dark brown, mottled sandy loam.

Among the minor soils in this association are the Fallcreek variant and Markey soils. Fallcreek variant soils are intermingled with Fallcreek soils on the higher parts of the ridges. Markey soils are along streams and in depressions near Cable soils.

Improving drainage and maintaining tilth and fertility are the main concerns in managing the major soils for cultivation. The major soils of this association are wet or have slow internal drainage. Because this association is located in the northeastern part of the county, the growing season is shorter than for much of the rest of the county. Crop varieties suited to the shortened growing season are needed.

Most areas of this association are used for permanent pasture, woodland, or wildlife habitat. Some areas are used for corn, small grain, and hay. The main farm enterprises are dairying and raising beef cattle.

The major soils in this association have mainly severe limitations for homesites (fig. 4), septic tank absorption fields, sanitary landfills, and local roads and streets.

6. Ludington-Elm Lake-Fairchild Association

Well drained to poorly drained loamy sands that are underlain by loamy sand, sand, loam and sandstone, or sandstone and shale; on uplands

This association consists of low, nearly level to sloping ridges intermingled with areas of wet soils. Nearly level and gently sloping areas have mostly medium slopes. Sloping areas have mostly medium or short slopes.

This association makes up about 12 percent of the county. It is about 33 percent Ludington soils, 28 percent Elm Lake soils, 10 percent Fairchild soils, and 29 percent minor soils.

Ludington soils are gently sloping and sloping. They are well drained and moderately well drained. These soils are on the tops and sides of low ridges. The surface layer typically is black loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 9 inches thick. The subsoil and accompanying subsurface layer combined are about 25 inches thick. They are dark brown and yellowish brown loamy sand and sand in the upper part and olive loam in the lower part. The substratum to a depth of about

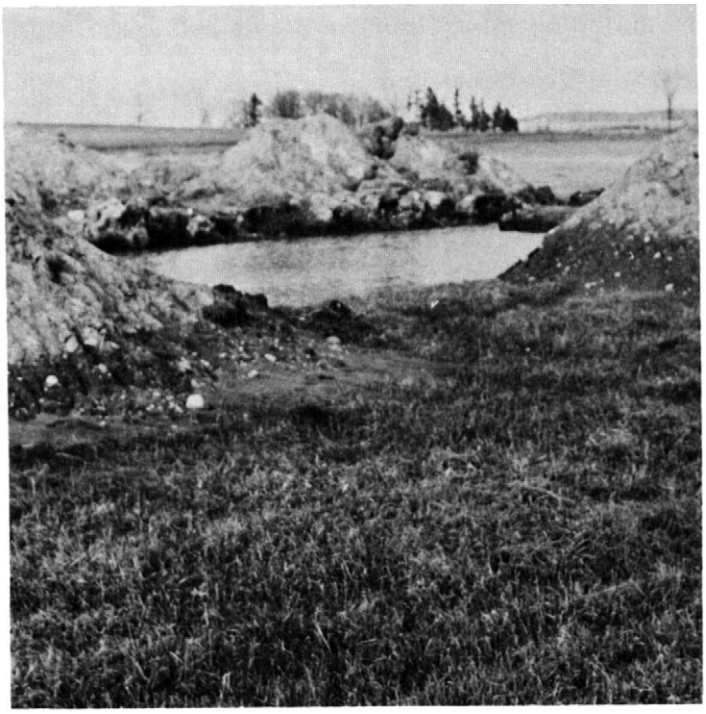

Figure 4.—**Abandoned basement excavation in a Fallcreek sandy loam.**

60 inches is very pale brown and olive layers of sandstone and shale.

Elm Lake soils are nearly level and are poorly drained. These soils are in depressions and along drainageways between upland ridges. The surface layer typically is black loamy sand about 1 inch thick. The substratum to a depth of about 60 inches is brown, grayish brown, and pale brown, mottled loamy sand and sand in the upper part and gray loam and light gray, very pale brown, and brownish yellow sandstone in the lower part.

Fairchild soils are nearly level and gently sloping and are somewhat poorly drained. These soils are on low ridges and swales. The surface layer typically is black loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 9 inches thick. The subsoil and accompanying subsurface layer combined are about 30 inches thick. They are dark brown, mottled loamy fine sand and pale brown, mottled sand in the upper part and light olive brown, mottled loam in the lower part. The substratum, to a depth of about 60 inches, is soft sandstone that has thin layers of shale.

Among the minor soils in this association are those of the Humbird, Merrillan, and Newson series. Humbird and Merrillan soils are intermingled with Ludington and Fairchild soils. Newson soils are wet and are underlain by loose outwash sand. They are in depressions between the ridges in positions similar to those of Elm Lake soils.

Improving drainage and maintaining tilth and fertility are the main concerns in managing the major soils for cultivation. Because of their low available water capacity the major soils in this association have medium or low potential for crops commonly grown in the county. Crop varieties suited to the short growing season are needed.

Most of this association is wooded and used for recreation and wildlife habitat. A few areas are used for such cultivated crops as corn, soybeans, small grain, and hay. The main farm enterprises are dairying and raising beef cattle.

The major soils in this association have mainly severe limitations for homesites, septic tank absorption fields, sanitary landfills, and local roads and streets. Ludington soils have moderate limitations for homesites and slight limitations for local roads and streets. Fairchild soils have moderate limitations for local roads and streets.

7. Billet-Meridian-Lows Association

Well drained to poorly drained sandy loams and loams that are underlain by loamy material and sand; on stream terraces

This association consists mainly of nearly level to sloping stream terraces in broad valleys. A few moderately steep areas are in this association. In most areas slopes range from medium length to long.

This association makes up about 12 percent of the county. It is about 41 percent Billett soils, 21 percent Meridian soils, 5 percent Lows soils, and 33 percent minor soils.

Billett soils are nearly level to moderately steep. They are well drained and moderately well drained. These soils are mainly on the higher stream terraces and on foot slopes adjacent to the uplands. The surface layer typically is very dark grayish brown sandy loam about 8 inches thick. The subsoil is about 26 inches thick. It is dark brown sandy loam in the upper part, dark yellowish brown heavy sandy loam in the middle, and yellowish brown sandy loam in the lower part. Below this to a depth of about 60 inches is yellowish brown fine and medium sand.

Meridian soils are nearly level to sloping and are mostly well drained. In some areas these soils are moderately well drained. These soils are mainly on the higher stream terraces and on foot slopes adjacent to the uplands. The surface layer and subsurface layer typically are very dark grayish brown and dark grayish brown loam about 11 inches thick. The subsoil is brown and dark brown loam about 19 inches thick. The substratum, to a depth of about 60 inches, is light yellowish brown sand.

Lows soils are nearly level. They are poorly drained. These soils are in swales and depressions on stream terraces. The surface layer typically is very dark gray loam about 8 inches thick. The subsurface layer is grayish brown loam about 6 inches thick. The subsoil is light brownish gray and gray, mottled loam about 14 inches thick. The substratum, to a depth of about 60 inches, is gray sand.

Among the minor soils in this association are those of the Gotham, Marshan, and Shiffer series. The nearly level, somewhat poorly drained Shiffer soils are in slightly higher lying areas adjoining peripheral areas of Lows soils. The poorly drained to very poorly drained Marshan soils are in depressions and are closely associated with Lows soils. The nearly level to sloping, somewhat excessively drained Gotham soils are intermingled with Billett soils.

Controlling erosion, maintaining tilth and fertility, and improving drainage in wet soils are the main concerns in managing the major soils for cultivation.

Most areas of this association are used for such cultivated crops as corn, soybeans, small grain, and hay. Steeper areas and undrained wet areas are used for permanent pasture and wildlife habitat. The main farm enterprises are growing cash crops, dairying, and raising beef cattle. The major soils of this association have medium to high potential for all cultivated crops commonly grown in the county.

Much of this association is near the city of Eau Claire and is used for rural nonfarm residences.

The nearly level to sloping, well drained Billett and Meridian soils have slight or moderate limitations for homesites, septic tank absorption fields, and local roads and streets. They have severe limitations for sanitary landfills. The moderately steep Billett soils have severe limitations for homesites, septic tank absorption fields, local roads and streets, and sanitary landfills. The moderately well drained Billett and Meridian soils have moderate limitations for homesites and local roads and streets and severe limitations for septic tank absorption fields and sanitary landfills.

Lows soils have severe limitations for homesites, septic tank absorption fields, local roads and streets, and sanitary landfills.

Descriptions of the Soils

The soil series and mapping units of Eau Claire County are described in this section. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Alluvial land, sandy, for example, does not belong to a soil series, but nevertheless it is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol which identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, woodland suitability group, wildlife group, and recreation group in which the mapping unit has been placed. The page where each soil has been described and the capability unit, woodland suitability group, or other interpretative group in which the soil has been placed is in the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*28*).[2]

Adrian Series

The Adrian series consists of very poorly drained, nearly level muck soils in depressions on outwash plains. These soils formed in deposits of organic material over sand. Native vegetation is sedges, grasses, reeds, alders, and water tolerant trees.

[2] Italic numbers in parentheses refer to Literature Cited, p. 141.

In a representative profile the surface layer is black muck about 36 inches thick. Below this to a depth of about 60 inches is gray sand.

Available water capacity is high in these soils, and natural fertility is low. Permeability is rapid. In undrained areas ground water is at or near the surface throughout the year.

A few areas of these soils are drained and used for crops or pasture. Most areas, however, remain in wetland woods, grasses, reeds, and alders. Limitations for most nonfarm uses are severe.

Representative profile of Adrian muck that has 0 to 2 percent slopes, in an uncultivated field, 200 feet south and 900 feet west of the northeast corner of the SE¼ sec. 16, T. 25 N., R. 9 W.:

Oa1—0 to 8 inches; black (N 2/0 broken face, 10YR 2/1 rubbed) sapric material; about 20 percent fibers, less than 5 percent rubbed; weak medium granular structure; mainly herbaceous fibers; medium acid; clear smooth boundary.

Oa2—8 to 12 inches; black (N 2/0 broken face, 10YR 2/1 rubbed) sapric material; about 25 percent fibers, less than 5 percent rubbed; weak very thick platy structure parting to weak medium subangular blocky; mainly herbaceous fibers; medium acid; clear smooth boundary.

Oa3—12 to 36 inches; black (10YR 2/1 broken face), very dark gray (10YR 3/1 rubbed) sapric material; about 25 percent fibers, less than 5 percent rubbed; very thick platy structure; mainly herbaceous fibers; medium acid; clear smooth boundary.

IIC—36 to 60 inches; gray (10YR 6/1) sand; single grained; loose; slightly acid.

Thickness of the organic soil over sand is commonly 16 to 42 inches, but it ranges from 16 to 51 inches. The organic material is black (N 2/0 and 10YR 2/1), very dark brown (10YR 2/2), and very dark gray (10YR 3/1). In places one or more layers lack structure and are massive. The reaction of the organic part of the soil and underlying sand ranges from medium acid to neutral.

Adrian soils formed in organic material similar to that in which Houghton and Markey soils formed. Adrian soils formed in organic material less than 51 inches thick, and Houghton soils formed in organic material more than 51 inches thick. Adrian soils are similar to Markey soils, but they are in the southern part of the county and have slightly higher temperatures than Markey soils.

Ad—Adrian muck (0 to 2 percent slopes). This nearly level soil is mainly in depressions in broad valleys. Small areas are in elongated pockets along small drainageways. Most areas range from 5 to 60 acres in size.

Included with this soil in mapping are small areas of Houghton soils that are generally in the center of the areas of Adrian muck.

Runoff is very slow on this soil, and ponding is common during wet seasons and after heavy rains. Surface drainage removes excess water rapidly. Both deep ditches and tile drains are used for internal drainage. If tile drains are used, precautions must be taken to prevent loose sand from entering the tile lines. In cultivated areas this soil is subject to soil blowing and burning. If the water table is lowered excessively, the organic matter decomposes very rapidly in cultivated areas, and subsidence becomes a concern. Crops grown on this soil are subject to frost damage.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Mapping unit	Acres	Percent
Adrian muck	4,800	1.2
Alluvial land, sandy	4,750	1.1
Alluvial land, wet	11,100	2.7
Arenzville silt loam, 0 to 3 percent slopes	4,550	1.1
Arland sandy loam, 2 to 6 percent slopes	440	.1
Arland sandy loam, 6 to 12 percent slopes, eroded	1,400	.3
Arland sandy loam, 12 to 20 percent slopes, eroded	620	.2
Au Gres loamy sand	2,900	.7
Billett sandy loam, 1 to 6 percent slopes	11,900	2.9
Billett sandy loam, 6 to 12 percent slopes, eroded	4,050	1.0
Billett sandy loam, 12 to 20 percent slopes, eroded	1,350	.3
Billett sandy loam, moderately well drained, 0 to 3 percent slopes	1,750	.4
Boone-Plainbo complex, 2 to 6 percent slopes	1,700	.4
Boone-Plainbo complex, 6 to 12 percent slopes	4,100	1.0
Boone-Plainbo complex, 12 to 45 percent slopes	8,800	2.1
Burkhardt sandy loam, 0 to 3 percent slopes	330	.1
Cable loam	5,200	1.3
Caryville loam, 0 to 3 percent slopes	1,100	.3
Chetek sandy loam, 1 to 6 percent slopes	570	.1
Chetek sandy loam, 6 to 12 percent slopes, eroded	870	.2
Chetek sandy loam, 12 to 20 percent slopes, eroded	680	.2
Curran silt loam	2,950	.7
Dakota loam, 0 to 3 percent slopes	260	.1
Dells silt loam	1,200	.3
Dunnville sandy loam, 0 to 3 percent slopes	960	.2
Eleva sandy loam, 2 to 6 percent slopes	5,100	1.2
Eleva sandy loam, 6 to 12 percent slopes, eroded	5,500	1.3
Eleva sandy loam, 12 to 20 percent slopes, eroded	2,550	.6
Elkmound loam, 2 to 6 percent slopes	3,100	.7
Elkmound loam, 6 to 12 percent slopes, eroded	4,500	1.1
Elkmound loam, 12 to 20 percent slopes, eroded	11,500	2.8
Elkmound loam, 20 to 45 percent slopes	13,800	3.4
Elm Lake loamy sand	13,300	3.3
Ettrick silt loam	1,750	.4
Fairchild and Merrillan soils, 0 to 2 percent slopes	3,250	.8
Fairchild and Merrillan soils, 2 to 6 percent slopes	9,500	2.3
Fallcreek sandy loam, 0 to 2 percent slopes	1,000	.2
Fallcreek sandy loam, 2 to 6 percent slopes	7,200	1.7
Fallcreek loam, moderately well drained variant, 2 to 6 percent slopes	1,600	.4
Fallcreek loam, moderately well drained variant, 6 to 12 percent slopes	770	.2
Friendship loamy sand, 0 to 3 percent slopes	5,500	1.3
Gale silt loam, 2 to 6 percent slopes	1,800	.4
Gale silt loam, 6 to 12 percent slopes, eroded	3,850	.9
Gale silt loam, 12 to 20 percent slopes, eroded	5,500	1.3
Gale silt loam, 20 to 30 percent slopes	3,700	.9
Gotham loamy sand, 1 to 6 percent slopes	2,800	.7
Gotham loamy sand, 6 to 12 percent slopes, eroded	1,900	.5
Gotham loamy sand, sandstone substratum, 2 to 6 percent slopes	900	.2
Gotham loamy sand, sandstone substratum, 6 to 12 percent slopes, eroded	480	.1
Hiles silt loam, 6 to 12 percent slopes, eroded	475	.1
Hiles and Kert soils, 2 to 6 percent slopes	1,500	.4
Hixton loam, 2 to 6 percent slopes	1,300	.3
Hixton loam, 6 to 12 percent slopes, eroded	1,600	.4
Hixton loam, 12 to 20 percent slopes, eroded	500	.1
Houghton muck	3,100	.7
Kert loam, 0 to 3 percent slopes	3,500	.8
Lows loam	2,450	.6
Ludington and Humbird soils, 2 to 6 percent slopes	6,600	1.6
Ludington and Humbird soils, 6 to 12 percent slopes	9,200	2.2
Markey muck	1,350	.3
Marshan loam	580	.1
Menahga sand, 1 to 6 percent slopes	41,600	10.1
Menahga sand, 6 to 12 percent slopes	2,050	.5
Meridian loam, 0 to 2 percent slopes	2,000	.5
Meridian loam, 2 to 6 percent slopes	5,100	1.2
Meridian loam, 6 to 12 percent slopes, eroded	1,550	.4
Meridian loam, moderately well drained, 0 to 3 percent slopes	870	.2
Morocco loamy sand	1,800	.4
Mt. Carroll silt loam, 2 to 6 percent slopes	1,950	.5
Mt. Carroll silt loam, 6 to 12 percent slopes, eroded	820	.2
Mt. Carroll silt loam, benches	500	.1
Newson loamy sand	7,800	1.9
Norden silt loam, 6 to 12 percent slopes, eroded	385	.1
Norden silt loam, 12 to 20 percent slopes, eroded	580	.1
Norden silt loam, 20 to 30 percent slopes, eroded	1,600	.4
Northfield silt loam, 2 to 6 percent slopes	3,350	.8
Northfield silt loam, 6 to 12 percent slopes, eroded	2,550	.6
Northfield silt loam, 12 to 20 percent slopes, eroded	2,600	.6
Northfield silt loam, 20 to 30 percent slopes, eroded	2,950	.7
Northfield silt loam, 30 to 45 percent slopes	1,900	.5
Orion silt loam	2,600	.6
Otter silt loam, overwash	1,600	.4
Otterholt silt loam, 2 to 6 percent slopes	890	.2
Otterholt silt loam, 6 to 12 percent slopes, eroded	920	.2
Pillot silt loam, 2 to 6 percent slopes	350	.1
Plainbo loamy sand, 2 to 6 percent slopes	3,250	.8
Plainbo loamy sand, 6 to 12 percent slopes, eroded	5,000	1.2
Plainfield loamy sand, 1 to 6 percent slopes	24,600	6.0
Plainfield loamy sand, 6 to 12 percent slopes, eroded	6,000	1.4
Plainfield loamy sand, loamy substratum, 1 to 6 percent slopes	4,350	1.1
Plainfield loamy sand, loamy substratum, 6 to 12 percent slopes, eroded	830	.2
Riverwash	520	.1
Seaton silt loam, 2 to 6 percent slopes	4,800	1.2
Seaton silt loam, 6 to 12 percent slopes, eroded	12,100	3.0
Seaton silt loam, 12 to 20 percent slopes, eroded	10,100	2.4
Seaton silt loam, 20 to 30 percent slopes, eroded	1,800	.4
Seaton silt loam, benches, 2 to 6 percent slopes	1,900	.5
Seaton silt loam, moderately well drained, 0 to 2 percent slopes	1,600	.4
Seaton silt loam, moderately well drained, 2 to 6 percent slopes	520	.1
Shiffer loam	2,450	.6
Sparta loamy sand, 1 to 6 percent slopes	2,450	.6
Tell silt loam, 0 to 2 percent slopes	700	.2
Tell silt loam, 2 to 6 percent slopes	1,200	.3
Terrace escarpments, sandy	6,800	1.6
Trempe loamy sand, 1 to 6 percent slopes	1,600	.4
Urne very fine sandy loam, 12 to 20 percent slopes, eroded	640	.2
Urne very fine sandy loam, 20 to 45 percent slopes	4,500	1.1
Veedum silt loam	1,750	.4
Vesper loam	3,300	.8
Vilas sand, 1 to 6 percent slopes	1,350	.3
Whitehall silt loam, deep variant	512	.1
Total	414,272	100.0

If adequately drained and protected from soil blowing, this soil is suited to forage crops, sod, and specialized cash and truck crops. Capability unit IVw–7; woodland suitability group 3w3; wildlife group 8; recreation group 8.

Alluvial Land

Ae—Alluvial land, sandy (0 to 2 percent slopes). This nearly level, excessively drained land type consists of stratified alluvium that is sand or loamy sand throughout. It is on flood plains. Most areas are long and narrow and range from 2 to 80 acres in size. Vegetation is a sparse cover of drought tolerant plants.

Included with this land type in mapping are small areas of Alluvial land, wet, and small areas of Riverwash.

Available water capacity is very low in this land type, and natural fertility is low. Permeability is rapid. Runoff is slow, and the erosion hazard is slight. This land type is subject to frequent flooding, and in places additional sand is deposited on the surface during major floods. In places enough sand is deposited to kill the vegetation. The water table is at or near the surface for short periods when the level of the stream is high, but it recedes rapidly as the stream level returns to normal. Management practices are needed to maintain plant cover and reduce the amount of damage caused by overflow.

This land type is used mainly for wildlife habitat and for recreational purposes. It has severe limitations for nonfarm uses. Capability unit VIIs–9; woodland suitability group 3s1; wildlife group 3; recreation group 7.

Af—Alluvial land, wet (0 to 2 percent slopes). This nearly level, poorly drained land type consists of alluvium on flood plains. The alluvium is sandy loam to silt loam in the surface layer and stratified sandy and loamy deposits below. Most areas are long and narrow and range from 2 to 100 acres in size. Vegetation is bluegrass, marsh grasses, willow, river birch, soft maple, and other moisture tolerant plants.

Included with this land type in mapping are small areas of Alluvial land, sandy.

Available water capacity is moderate to high in this land type. Permeability and natural fertility are too variable to rate. Runoff is slow, and the erosion hazard is none to slight. This land type is subject to frequent flooding, and the water table is at or near the surface most of the year. Many areas are dissected by sloughs, oxbows, and old stream channels. Some of these areas remain inundated for several days following major floods. During this time additional stream sediment is deposited, or the channels of the streams shift to a new course.

This land type is used mainly for woodland, permanent pasture, and wildlife habitat. It has severe limitations for nonfarm uses. Capability unit Vw–14; woodland suitability group 4w2; wildlife group 7; recreation group 7.

Arenzville Series

The Arenzville series consists of moderately well drained and well drained, nearly level and gently sloping, silty soils in major drainageways. Native vegetation is mainly elm, red maple, cottonwood, and black willow.

In a representative profile the surface layer is dark grayish brown silt loam about 8 inches thick. Below this is dark grayish brown silt loam that is about 20 inches thick and has very dark grayish brown and brown strata throughout. An older, buried soil is at a depth of about 28 inches. The buried surface layer is black silt loam about 11 inches thick. The substratum to a depth of about 60 inches is brown, mottled silt loam.

Permeability is moderate in these soils. Available water capacity is very high, and natural fertility is high. During wet periods some areas of these soils are saturated at a depth of 3 to 5 feet.

Most areas of these soils are used for cultivated crops and pasture. Arenzville soils are well suited to grasses and are suited to crops if protection from seasonal flooding is provided. They are also suited to open land wildlife habitat and woodland. Limitations for nonfarm uses are moderate to severe.

Representative profile of Arenzville silt loam, 0 to 3 percent slopes, in a cultivated field, 200 feet north and 100 feet west of the southeast corner of sec. 11, T. 26 N., R. 8 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable; medium acid; abrupt smooth boundary.

C1—8 to 28 inches; dark grayish brown (10YR 4/2) silt loam, thin strata of very dark grayish brown (10YR 3/2) and brown (10YR 5/3) silt loam; weak medium platy structure; friable; medium acid; abrupt smooth boundary.

Ab—28 to 39 inches; black (10YR 2/1) silt loam; weak medium granular structure; friable; medium acid; clear smooth boundary.

C2—39 to 60 inches; brown (10YR 5/3) silt loam; common medium prominent strong brown (7.5YR 5/8) mottles and common medium faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; medium acid.

Minor color variations exist throughout the profile because of the stratification of different kinds of sediment. Depth to the buried Ab horizon is 20 to 40 inches. The Ab horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2).

Arenzville soils are near Caryville and Orion soils. Arenzville soils are finer textured than Caryville soils. They formed in material similar to that in which Orion soils formed, but they are better drained than those soils.

ArA—Arenzville silt loam, 0 to 3 percent slopes. This soil is along former stream channels. Individual areas are long and narrow and range from 2 to 40 acres in size.

Included with this soil in mapping are small areas of Orion and Otter soils and areas of soils that have thin, sandy deposits on the surface and thin sand layers throughout the profile. Areas that have sandy deposits on the surface are indicated on the soil map by sand spot symbols.

Runoff is slow, and the erosion hazard is slight. Flooding is a hazard, and water ponds temporarily. Management practices are needed to remove excess water and provide protection from flooding.

If excess water is removed and protection from flooding is provided, this soil is well suited to all crops

commonly grown in the county. This soil has moderate or severe limitations for most nonfarm uses. Capability unit IIw–11; woodland suitability group 2o1; wildlife group 9; recreation group 7.

Arland Series

The Arland series consists of well drained, gently sloping to moderately steep, loamy soils on uplands. These soils formed in glacial material and residuum derived from sandstone. Native vegetation is mainly oak, maple, elm, and ash.

In a representative profile the surface layer is dark grayish brown sandy loam about 7 inches thick. The subsurface layer is brown sandy loam about 6 inches thick. The subsoil is about 21 inches thick. It is yellowish brown sandy loam in the upper part, reddish brown heavy sandy loam in the middle part, and brown sandy loam in the lower part. The substratum to a depth of about 60 inches is brown loamy sand in the upper part and yellowish brown sandstone in the lower part.

Available water capacity is low in these soils, and natural fertility is low to medium. Permeability is moderate.

Most areas of these soils are used for crops. Areas of gently sloping and sloping soils are moderately well suited to cultivated crops. In places areas are used for woodland, wildlife habitat, and selected recreational purposes. Limitations for many nonfarm uses are moderate to severe.

Representative profile of Arland sandy loam, 6 to 12 percent slopes, eroded, in a cultivated field, 400 feet east and 50 feet south of the northwest corner of the NE¼ sec. 34, T. 27 N., R. 10 W.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) sandy loam; moderate fine subangular blocky structure; friable; strongly acid; abrupt smooth boundary.

A2—7 to 13 inches; brown (10YR 5/3) sandy loam; weak medium platy structure; friable; slightly acid; clear smooth boundary.

B1—13 to 17 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; friable; light gray (10YR 7/2) dry silt coatings on ped faces; slightly acid; clear wavy boundary.

B2t—17 to 27 inches; reddish brown (5YR 4/4) heavy sandy loam; moderate medium subangular blocky structure; friable; thin light gray (10YR 7/2) dry silt coatings on ped faces; patchy thin clay films on ped surface; few glacial pebbles and small stones throughout this horizon; strongly acid; clear smooth boundary.

B3—27 to 34 inches; brown (7.5YR 5/4) sandy loam; weak fine and medium subangular blocky structure; friable; strongly acid; clear smooth boundary.

IIC1—34 to 40 inches; brown (7.5YR 5/4) loamy sand; weak coarse subangular blocky structure; very friable; strongly acid; gradual wavy boundary.

IIC2—40 to 60 inches; yellowish brown (10YR 5/6) weakly cemented sandstone.

Thickness of the solum typically is 24 to 36 inches. Depth to sandstone ranges from 20 to 40 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) sandy loam or loam. The B2t horizon is sandy clay loam, loam, or heavy sandy loam. Few to many glacial stones and pebbles are in the solum.

Arland and Eleva soils are both underlain by sandstone. Arland soils, however, have a finer textured B2t horizon than Eleva soils.

AtB—Arland sandy loam, 2 to 6 percent slopes. This gently sloping soil is on ridgetops. Most areas have elongated shapes and range from 2 to 40 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer is slightly thicker.

Included with this soil in mapping are small areas of a soil that has a surface layer of loam and areas of a soil that is underlain by hard sandstone.

Runoff is slow, and the erosion hazard is slight. Low available water capacity limits crop yields during most years. Management practices are needed to supply organic matter, conserve moisture, and reduce runoff.

Most areas of this soil are used for crops. This soil is moderately well suited to all crops commonly grown in the county. It has moderate or severe limitations for most nonfarm uses. Capability unit IIIs–4; woodland suitability group 2o1; wildlife group 1; recreation group 2.

AtC2—Arland sandy loam, 6 to 12 percent slopes, eroded. This sloping soil is on low ridges. Most areas are long and narrow and range from 2 to 60 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas where the surface layer is either thinner or thicker than the one in the profile described as representative for the series. Also included are small areas of a soil that has a surface layer of loam and areas of a soil that is underlain by hard sandstone.

Runoff is medium, and the erosion hazard is moderate. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion, supply organic matter, conserve moisture, and reduce runoff.

Most areas of this soil are used for crops. This soil is moderately well suited to all crops commonly grown in the county. It has moderate or severe limitations for many nonfarm uses. Capability unit IIIe–7; woodland suitability group 2o1; wildlife group 1; recreation group 2.

AtD2—Arland sandy loam, 12 to 20 percent slopes, eroded. This moderately steep soil is on the sides of low ridges. Most areas are long and narrow and range from 2 to 60 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer and subsoil are slightly thinner than the ones in the representative profile.

Included with this soil in mapping are small areas of Chetek and Elkmound soils and small areas where the surface layer is either thinner or thicker than the one in the profile described as representative for the series. Also included are a few small areas of a soil that has a surface layer of loam and a few areas of a soil that is underlain by hard sandstone.

Runoff is rapid, and the erosion hazard is severe. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion, supply organic matter, conserve moisture, and reduce runoff.

Most areas of this soil are used for crops. Unless carefully managed, this soil is not well suited to culti-

vated crops commonly grown in the county. It has severe limitations for most nonfarm uses. Capability unit IVe–7; woodland suitability group 2r1; wildlife group 1; recreation group 2.

Au Gres Series

The Au Gres series consists of somewhat poorly drained, nearly level, sandy soils on stream terraces and outwash plains. Native vegetation is pine and hardwood forest.

In a representative profile (fig. 5) the surface layer is black loamy sand about 2 inches thick. The subsurface layer is pinkish gray sand about 12 inches thick. The subsoil is about 11 inches thick and is mottled throughout. The upper 6 inches is dark reddish brown and dark brown sand, and the lower 5 inches is dark yellowish brown sand. Below the subsoil to a depth of about 60 inches is light brownish gray sand.

Available water capacity is very low in these soils, and natural fertility is low. Permeability is rapid. In undrained areas these soils are saturated at a depth of 1 to 3 feet during wet periods.

Nearly all areas of Au Gres soils are wooded. Pine, aspen, and scrub oak are in the wooded areas. If adequately drained, these soils can be used for cultivated crops. They are suited to such trees as aspen, white and jack pine, and white and black spruce. Limitations for many nonfarm uses are moderate or severe.

Representative profile of Au Gres loamy sand that has 0 to 2 percent slopes, in a wooded area, 1,000 feet north and 50 feet west of the southeast corner of the NE¼ sec. 15, T. 27 N., R. 5 W.:

A1—0 to 2 inches; black (10YR 2/1) loamy sand; moderate fine granular structure; very friable; some light gray (10YR 7/1) sand grains; strongly acid; abrupt smooth boundary.

A2—2 to 14 inches; pinkish gray (7.5YR 6/2) medium and fine sand; single grained; loose; medium acid; abrupt wavy boundary.

B21hir—14 to 16 inches; dark reddish brown (5YR 3/3) medium and fine sand; few medium faint dark brown (7.5YR 4/4) mottles; very weak medium subangular blocky structure; very friable; few ½- to 1-inch diameter chunks of weakly cemented ortstein; strongly acid; clear wavy boundary.

B22ir—16 to 20 inches; dark brown (7.5YR 4/4) medium and fine sand; common medium faint yellowsih brown (10YR 5/4) mottles; very weak medium subangular blocky structure, single grained where disturbed; loose; medium acid; clear wavy boundary.

B3—20 to 25 inches; dark yellowish brown (10YR 4/4) medium and fine sand; common medium faint brown (10YR 5/3) and yellowish brown (10YR 5/4) mottles; single grained; loose; medium acid; gradual wavy boundary.

C—25 to 60 inches; light brownish gray (10YR 6/2) medium and fine sand; single grained; loose; medium acid.

Thickness of the solum ranges from 20 to 36 inches. The A1 horizon is black (10YR 2/1) or very dark gray (10YR 3/1). Where the soil is cultivated, the Ap horizon is dark grayish brown (10YR 4/2), dark gray (10YR 4/1), or very dark gray (10YR 3/1). Texture is sand or loamy sand. The A2 horizon is pinkish gray (7.5YR 6/2) or light brownish gray (10YR 6/2) sand or loamy sand. In cultivated areas the A2 horizon is thin or lacking. The B2 horizon is dark reddish brown (5YR 3/3) or dark brown (7.5 YR 4/4) and is mottled. It is typically sand but ranges to loamy sand.

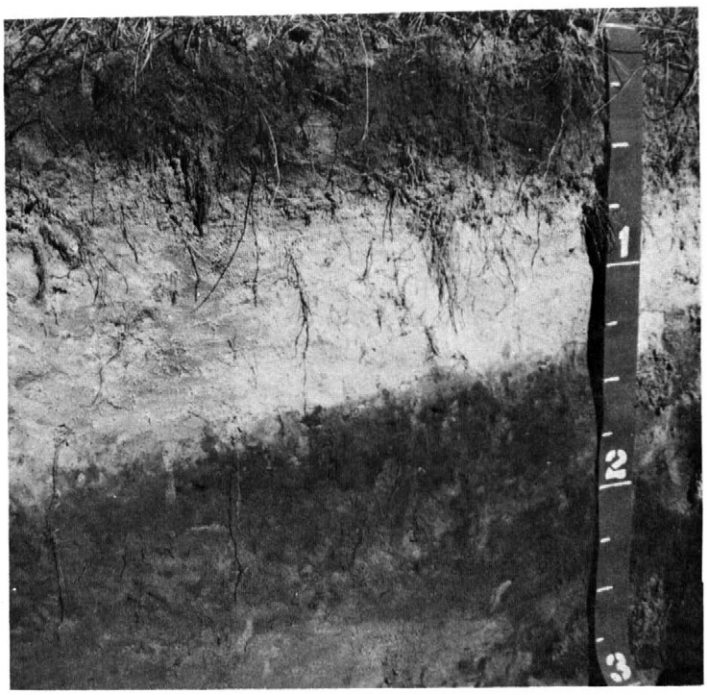

Figure 5.—**Profile of Au Gres loamy sand. The leached subsurface is pinkish gray; the subsoil, which contains iron and humus, is in shades of brown.**

The C horizon is light brownish gray (10YR 6/2), grayish brown (10YR 5/2), or brown (10YR 5/3).

Au Gres soils formed in material similar to that in which Friendship and Newson soils formed. Au Gres soils are somewhat poorly drained, but Friendship soils are moderately well drained and Newson soils are poorly drained.

Au—Au Gres loamy sand (0 to 2 percent slopes). This nearly level soil is on broad, smooth valley plains. Some areas are large and round, and smaller areas are either irregularly shaped or are elongated tracts along streams or surrounding areas of poorly drained soils. Most areas range from 10 to 100 acres in size.

Included with this soil in mapping are small areas of Friendship and Newson soils. Also included are areas of a soil that has a surface layer of sand.

Runoff is slow, and the erosion hazard is slight. This soil receives runoff from adjoining areas and is commonly ponded in spring and after heavy rains. During the growing season, the water table recedes, and the lack of available water limits growth of crops. Crops grown on this soil are subject to frost damage. Surface drainage removes excess water rapidly. Both deep ditches and tile drains are used for internal drainage. If tile drainage is used, care must be taken to prevent loose sand from entering the tile lines. Management practices are needed to control drainage and supply organic matter.

Most areas of this soil are wooded, but a few small areas have been cleared and are used for crops or pasture. If adequately drained, this soil is suited to cultivated crops, but it is better suited to pasture or wildlife habitat. It has moderate or severe limitations for nonfarm uses. Capability unit IVw–5; woodland suitability group 3s2; wildlife group 6; recreation group 5.

Billett Series

The Billett series consists of well drained and moderately well drained, nearly level to moderately steep, loamy soils on outwash plains. Native vegetation is scattered oak, elm, and maple and prairie grasses.

In a representative profile the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsoil is about 26 inches thick. It is dark brown sandy loam in the upper 9 inches, dark yellowish brown heavy sandy loam in the middle 8 inches, and yellowish brown sandy loam in the lower 9 inches. The substratum to a depth of about 60 inches is yellowish brown fine and medium sand.

Available water capacity and natural fertility are low. Permeability is moderately rapid.

Most areas of these soils are used for crops. A few areas remain in woods or are in permanent pasture. Nearly level to sloping soils in this series are moderately well suited to farming, but they are somewhat droughty. The soils in this series are also suited to wildlife habitat and woodland. Limitations for most nonfarm uses are slight or moderate for areas of nearly level to sloping soils. Moderately steep areas have severe limitations for most nonfarm uses.

Representative profile of Billett sandy loam, 1 to 6 percent slopes, in a cultivated field, 700 feet south and 100 feet west of the northeast corner of sec. 12, T. 26 N., R. 9 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) when dry; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

B1—8 to 17 inches; dark brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

B2t—17 to 25 inches; dark yellowish brown (10YR 4/4) heavy sandy loam; moderate medium subangular blocky structure; friable; thin patchy clay films; strongly acid; clear smooth boundary.

B3—25 to 34 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; friable; strongly acid; clear smooth boundary.

C—34 to 60 inches; yellowish brown (10YR 5/4) fine and medium sand; single grained; loose; strongly acid.

Thickness of the solum or depth to underlying sand ranges from about 20 to 40 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). In places there is a thin, dark grayish brown (10YR 4/2) or brown (10YR 5/3) A2 horizon. The B2t horizon is sandy loam or heavy sandy loam. The B3 horizon commonly is sandy loam, but it includes bands of loamy sand.

Billett soils are near Dunnville, Gotham, and Meridian soils. Billett soils have a thinner and lighter colored surface layer than Dunnville soils, and they lack the reddish brown colors of those soils. The B horizon in Billett soils is finer textured than the B horizon in Gotham soils. The A and B horizons in Billett soils are coarser textured than the A and B horizons in Meridian soils.

B1B—Billett sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping soil is on stream terraces and undulating plains. Most areas are irregularly shaped and range from 10 to 100 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Gotham and Meridian soils.

Runoff is slow, and the erosion hazard is slight. Low available water capacity limits crop yields during most years. Management practices are needed to supply organic matter, conserve moisture, and reduce runoff.

Most areas of this soil are used for cultivated crops. Some areas are used for homesites. This soil is moderately well suited to all crops commonly grown in the county. It has slight limitations for most nonfarm uses. Capability unit IIIs–4; woodland suitability group 3o1; wildlife group 1; recreation group 2.

B1C2—Billett sandy loam, 6 to 12 percent slopes, eroded. This sloping soil is mainly in valleys of small streams. Most areas are long and narrow or irregularly shaped. They range from 8 to 60 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer and subsoil are thinner than the ones in the representative profile. Depth to underlying sand generally is less than 30 inches.

Included with this soil in mapping are small areas of Eleva and Gotham soils. Also included are small areas of severely eroded Billett soils.

Runoff is medium, and the erosion hazard is moderate. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion, supply organic matter, conserve moisture, and reduce runoff.

Most areas of this soil are used for cultivated crops, but some areas are in pasture or are wooded. If properly managed, this soil is moderately well suited to all crops commonly grown in the county. It has slight or moderate limitations for most nonfarm uses. Capability unit IIIe–7; woodland suitability group 3o1; wildlife group 1; recreation group 2.

B1D2—Billett sandy loam, 12 to 20 percent slopes, eroded. This moderately steep soil is mainly in long, narrow bands on the edges of stream terraces. Most areas range from 2 to 30 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer and subsoil are thinner than the ones in the representative profile. Depth to underlying sand is commonly less than 30 inches.

Included with this soil in mapping are small areas of Eleva and Elkmound soils. Also included are small areas of severely eroded Billett soils.

Runoff is rapid, and the erosion hazard is severe. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion, supply organic matter, conserve moisture, and reduce runoff.

Most areas of this soil are used for grain and hay crops. Many areas are maintained in permanent pasture and are periodically renovated. Some areas are planted to pine trees. Unless carefully managed, this soil is not well suited to cultivated crops commonly grown in the county. It has severe limitations for most nonfarm uses. Capability unit IVe–7; woodland suitability group 3r1; wildlife group 1; recreation group 2.

BmA—Billett sandy loam, moderately well drained, 0 to 3 percent slopes. This nearly level and gently sloping soil is mainly on flats and in slight depressions

on broad stream terraces and outwash plains. Some small, irregularly shaped areas are at the base of sandstone uplands. Most areas range from 4 to 60 acres in size. This soil has a profile similar to the one described as representative for the series except for mottles in the lower part of the subsoil.

Included with this soil in mapping are small areas of Billett and Shiffer soils.

Runoff is slow, and the erosion hazard is slight. This soil has a seasonal water table at a depth of 3 to 5 feet during wet seasons. Low available water capacity limits crops yields during most seasons. Management practices are needed to divert and remove runoff, supply organic matter, and conserve moisture during dry periods.

Most areas of this soil are used for crops. This soil is moderately well suited to all crops commonly grown in the county. It has moderate or severe limitations for most nonfarm uses. Capability unit IIIs–4; woodland suitability group 3o1; wildlife group 1; recreation group 2.

Boone Series

The Boone series consists of excessively drained, gently sloping to very steep soils on the tops and sides of ridges on the sandstone uplands. These soils formed in sand weathered from sandstone. Native vegetation is dominantly hardwood trees and a few pine trees.

In a representative profile the surface layer is very dark grayish brown sand about 3 inches thick. Below this to a depth of about 26 inches is yellowish brown and yellow fine and medium sand. This is underlain by very pale brown and strong brown, weakly cemented, banded sandstone that extends to a depth of about 60 inches.

Available water capacity is very low in these soils, and natural fertility is low. Permeability is very rapid.

Most areas of these soils are in woods or grass. Some areas of small, gently sloping soils are used for crops, but many pine trees have been planted in such areas. In other small areas of gently sloping soils, the vegetation is reverting to native hardwoods. These soils are not suited to cultivated crops. Unless irrigated these soils are suited only to trees or plants that do not require large amounts of water. Limitations for many nonfarm uses are moderate or severe.

The Boone soils in this county are mapped only in a complex with Plainbo soils.

Representative profile of Boone sand in a wooded area of Boone-Plainbo complex, 12 to 45 percent slopes, 400 feet south and 700 feet west of the northeast corner of the SE¼ sec. 28, T. 26 N., R. 10 W.:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) sand; weak fine granular structure; very friable; strongly acid; abrupt smooth boundary.

C1—3 to 13 inches; yellowish brown (10YR 5/6) fine and medium sand; single grained; loose; strongly acid; clear smooth boundary.

C2—13 to 26 inches; yellow (10YR 7/6) fine and medium sand; single grained; loose; few small sandstone fragments in lower part; strongly acid; clear smooth boundary.

C3—26 to 60 inches; very pale brown (10YR 8/4) and strong brown (7.5YR 5/8) weakly cemented sandstone bedrock; strongly acid.

Sandstone bedrock is at a depth of 20 to 40 inches. Where the soil is cultivated, the Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) and ranges from 4 to 6 inches in thickness. In some uncultivated areas there is an A2 horizon that is grayish brown (10YR 5/2) or pale brown (10YR 6/3) and is 2 to 4 inches thick. The A1 horizon ranges from 1 to 4 inches in thickness. It is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2).

Boone soils are near Eleva, Elkmound, Plainbo, and Plainfield soils. They contain less clay than Eleva and Elkmound soils and fewer weatherable minerals than Plainbo and Plainfield soils. (The soil material of Boone soils is less than 5 percent weatherable minerals.)

BoB—Boone-Plainbo complex, 2 to 6 percent slopes. The gently sloping soils in this complex are on the side slopes and ridgetops of sandstone uplands. Most areas are long and narrow and range from 2 to 40 acres in size.

This complex is about 40 to 50 percent Boone sand and 30 to 40 percent Plainbo loamy sand. The rest is mainly small areas of Plainfield loamy sand. The Boone and Plainbo soils have profiles similar to those described as representative for their respective series. Both soils are deeper to sandstone than the representative soil, however, and Boone sand has a thicker and lighter colored surface layer in areas that are or were cultivated.

Runoff is slow, and the erosion hazard is slight. These soils are subject to soil blowing. Management practices are needed to maintain plant cover, conserve moisture, and control erosion and soil blowing.

About two-thirds of this complex is wooded. The rest is used for crops or pasture or is left idle. Many areas are planted to pine trees. These soils are unsuited to cultivated crops. Unless the soils are irrigated, they support only vegetation that does not require large amounts of water, such as grass, scrub oak, or pine trees. These soils have moderate or severe limitations for most nonfarm uses. Capability unit VIIs–9; woodland suitability group 3s1; wildlife group 3; recreation group 4.

BoC—Boone-Plainbo complex, 6 to 12 percent slopes. The sloping soils in this complex are on the crests and sides of sandstone ridges. Most areas are long and narrow and range from 4 to 60 acres in size.

This complex is about 40 to 50 percent Boone sand and 30 to 40 percent Plainbo loamy sand. The rest is mainly small areas of Plainfield loamy sand. The Boone and Plainbo soils have profiles similar to those in the soils described as representative for their respective series. The Boone soil has a slightly thicker surface layer than the one in the representative Boone soil, however, and the Plainbo soil, unlike the representative soil, is not eroded

Included with this complex in mapping are small areas of moderately eroded Boone and Plainbo soils.

Runoff is slow or medium, and the erosion hazard is moderate. These soils are subject to soil blowing. Management practices are needed to maintain plant cover, conserve moisture, and control erosion and soil blowing.

Most areas of this complex are wooded. A few small areas that were used for crops are now used mainly for pasture. Many open areas are planted to pine trees. These soils are unsuited to crops and are better maintained in permanent vegetative cover. They have moderate or severe limitations for most nonfarm uses. Capability unit VIIs–9; woodland suitability group 3s1; wildlife group 3; recreation group 4.

BoE—Boone-Plainbo complex, 12 to 45 percent slopes. The moderately steep to very steep soils in this complex are on the sides of sandstone hills and ridges. Most areas are long and narrow or irregularly shaped and range from 10 to 160 acres in size.

This complex is about 50 to 60 percent Boone sand and 20 to 30 percent Plainbo loamy sand. The rest is small areas of Eleva and Elkmound soils. The Boone soil in this complex has the profile described as representative for its series. The Plainbo soil has a profile similar to the one described as representative for its series, but the surface layer is thinner than the one in the representative profile, and the underlying sandstone is slightly shallower.

Included with this complex in mapping, especially in areas that have slopes of more than 20 percent, are thin sandy soils that range from a few inches to 20 inches thick over sandstone. Sandstone outcrops on sharp breaks and ridge points are indicated by a spot symbol on the soil map.

Runoff is medium to rapid, and the erosion hazard is severe. These soils are subject to soil blowing. Management practices are needed to maintain plant cover, conserve moisture, and control erosion and soil blowing.

Most areas of this complex are wooded. Many small areas that were used for crops or pasture are now planted to pine trees or are left idle. These soils are better suited to wildlife habitat or to such permanent vegetation as trees than they are to crops. They have moderate or severe limitations for most nonfarm uses. Capability unit VIIs–9; woodland suitability group 3s3; wildlife group 3; recreation group 4.

Burkhardt Series

The Burkhardt series consists of somewhat excessively drained, nearly level and gently sloping, loamy soils underlain by sand and gravel. These soils are on stream terraces. Native vegetation is mixed prairie grasses.

In a representative profile the surface layer is very dark brown sandy loam about 10 inches thick. The subsoil is about 8 inches thick. It is dark brown sandy loam in the upper 6 inches and dark brown gravelly loamy sand in the lower 2 inches. The substratum to a depth of about 60 inches is pale brown stratified sand and gravel.

Permeability is moderately rapid. Available water capacity and natural fertility are low.

Most areas of these soils are used for cultivated crops. These soils are moderately well suited to most of the crops commonly grown in the county. They are well suited to open land wildlife habitat and are moderately well suited to woodland. Limitations for most nonfarm uses are slight or moderate.

Representative profile of Burkhardt sandy loam, 0 to 3 percent slopes, in a cultivated field, 600 feet south and 50 feet west of the northeast corner of the SE¼ sec. 7, T. 26 N., R. 10 W.:

Ap—0 to 10 inches; very dark brown (10YR 2/2) sandy loam; weak fine subangular blocky structure; friable; strongly acid; abrupt smooth boundary.

B2t—10 to 16 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; clay bridging between sand grains; medium acid; clear smooth boundary.

IIB3—16 to 18 inches; dark brown (7.5YR 4/4) gravelly loamy sand; weak fine subangular blocky structure; very friable; medium acid; clear smooth boundary.

IIC—18 to 60 inches; pale brown (10YR 6/3) sand and gravel; single grained; loose; medium acid.

Thickness of the solum is commonly about 18 inches, but it ranges from 10 to 20 inches. The Ap horizon is black (10YR 2/1) or very dark brown (10YR 2/2). The A and B horizons and the underlying material are 20 to 35 percent fine and medium gravel.

Burkhardt soils are near Chetek, Dakota, and Sparta soils. Burkhardt soils have a darker colored and thicker surface layer than Chetek soils. They have thinner A and B horizons than Dakota soils, and they are coarser textured than those soils. Burkhardt soils are finer textured than Sparta soils.

BuA—Burkhardt sandy loam, 0 to 3 percent slopes. This nearly level and gently sloping soil is on broad stream terraces. Most areas are long, wide, and regularly shaped. They range from 6 to 60 acres in size.

Included with this soil in mapping are small areas of Dakota and Sparta soils. Also included are areas of this soil that have a surface layer of loam or gravelly loam. Small areas where the surface layer is gravelly loam are indicated by gravel spot symbols on the soil map.

Runoff is slow, and the erosion hazard is slight. Low available water capacity limits crop yields during most seasons. Management practices are needed to supply organic matter and conserve moisture.

Most areas of this soil are used for crops. This soil is moderately well suited to most crops commonly grown in the county. In some areas this soil is a source of gravel for commercial uses. This soil has slight or moderate limitations for most nonfarm uses. Capability unit IIIe–3; woodland suitability group 3d1; wildlife group 4; recreation group 3.

Cable Series

The Cable series consists of poorly drained, nearly level, loamy soils in depressions on till plains. Native vegetation is trees, grasses, and sedges that require large amounts of water.

In a representative profile the surface layer is very dark gray loam about 5 inches thick. The subsurface layer is about 10 inches thick and is mottled. It is dark gray loam in the upper part and gray sandy loam in the lower part. The subsoil is about 27 inches thick. It is gray light loam in the upper part and brown sandy loam in the lower part. The subsoil is mottled with dark brown, brown, and strong brown. The substratum to a depth of about 6 inches is dark brown, mottled sandy loam.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderate. In undrained areas ground water is at or near the surface throughout the year.

Most areas of these soils are in permanent grasses and are used for pasture or wildlife habitat. A few small areas have been drained and are used for crops. Where these soils are drained, they are suited to forage crops. The soils are generally poorly suited to woodland. Limitations for most nonfarm uses are severe.

Representative profile of Cable loam that has 0 to 2 percent slopes, in an uncultivated area, 700 feet south and 100 feet west of the northeast corner of sec. 12, T. 16 N., R. 9 W.:

A1—0 to 5 inches; very dark gray (10YR 3/1) loam; weak medium granular structure; friable; medium acid; clear smooth boundary.

A21g—5 to 8 inches; dark gray (10YR 4/1) loam; weak medium granular structure; friable; medium acid; clear smooth boundary.

A22g—8 to 15 inches; gray (10YR 5/1) sandy loam; few coarse distinct brown (10YR 5/3) mottles and few coarse prominent yellowish brown (10YR 5/4) mottles; weak medium platy structure; friable; medium acid; clear wavy boundary.

B2g—15 to 36 inches; gray (5YR 5/1) light loam; common medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

B3g—36 to 42 inches; brown (7.5YR 5/2) sandy loam; common medium distinct dark brown (7.5YR 4/4) and brown (7.5YR 5/4) mottles; weak medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C—42 to 60 inches; dark brown (7.5YR 4/4) sandy loam; common medium distinct brown (7.5YR 5/2) mottles; massive; friable; medium acid.

Thickness of the solum ranges from 20 to 45 inches. In places few to many stones are on the surface. The A1 horizon is very dark gray (10YR 3/1) or black (10YR 2/1). In cultivated areas there is no A21g horizon. The A22g horizon is gray (10YR 5/1), grayish brown (10YR 5/2), or light brownish gray (10YR 6/2). The B2g horizon is gray (5Y 5/1), brown (7.5YR 5/2), or olive gray (5Y 5/2) loam or sandy loam. The B3g and C horizons are brown (7.5YR 5/2), dark brown (7.5YR 4/4), or gray (5Y 5/1) and olive gray (5Y 5/2). In places the B and C horizons are 5 to 10 percent, by volume, coarse fragments. In most areas these soils have a redder hue than is in the defined range for the series, but this difference does not alter their usefulness and behavior.

Cable soils are near Fallcreek soils. Cable soils have a darker A horizon, a grayer B horizon, and a coarser textured C horizon than Fallcreek soils. They are also wetter than Fallcreek soils.

Cb—Cable loam (0 to 2 percent slopes). This nearly level soil is mainly in swales and depressions on glacial till plains. Many areas are in broad basins within the uplands. Most areas range from 20 to 200 acres in size.

Included with this soil in mapping are small areas of Cable soils that are very poorly drained and small areas of Markey soils. Also included are areas of Cable soils that have a surface layer of sandy loam.

Runoff is very slow, and the erosion hazard is slight. This soil receives runoff from adjoining areas and is commonly ponded during wet seasons and after heavy rains. Crops grown on this soil are subject to frost damage. Surface drainage removes excess water rapidly. Both deep ditches and tile drains are used for internal drainage.

Most areas of this soil are in marsh grass, water tolerant shrubs, or trees and are used for permanent pasture. A few small areas are drained and used for crops. If adequately drained, this soil is suited to small grain and forage crops. It is also suited to pasture and wildlife habitat. It has severe limitations for nonfarm uses. Capability unit IIIw–3; woodland suitability group 3w2; wildlife group 7; recreation group 6.

Caryville Series

The Caryville series consists of well drained, nearly level and gently sloping, loamy soils on stream bottoms and terraces. These soils are underlain by loamy sand, sand, or sand and gravel. Native vegetation is tall prairie grasses.

In a representative profile the surface layer is about 16 inches thick. The upper 9 inches is very dark brown loam, and the lower 7 inches is dark brown loam. The substratum to a depth of about 60 inches is dark brown loamy sand in the upper 8 inches and brown, loose fine and medium sand below.

Available water capacity and natural fertility are low in these soils. Permeability is moderate to a depth of about 20 inches and rapid below. These soils are subject to occasional flooding of short duration.

Most areas of these soils are used for crops. Some areas are used for woodland and wildlife habitat. These soils are suited to crops, pasture, woodland, and wildlife habitat. Limitations for nonfarm uses are mostly severe.

Representative profile of Caryville loam, 0 to 3 percent slopes, in a cultivated field, 400 feet south and 200 feet east of the northwest corner of sec. 7, T. 26 N., R. 10 W.:

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam; moderate fine and medium subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A12—9 to 16 inches; dark brown (7.5YR 3/2) loam; weak very thick platy structure parting to weak medium subangular blocky; friable; medium acid; clear smooth boundary.

IIC1—16 to 24 inches; dark brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; medium acid; gradual smooth boundary.

IIC2—24 to 60 inches; brown (7.5YR 5/4) fine and medium sand; single grained; loose; medium acid.

The Ap horizon is very dark brown (10YR 2/2) or dark brown (7.5YR 3/2). Thickness of the A horizon ranges from 10 to 20 inches. The C horizon is loamy sand or fine and medium sand. In places the C horizon has thin gravel strata or thin layers of loamy sediment.

Caryville soils are near Arenzville and Dunnville soils. Caryville soils are coarser textured than Arenzville soils. They have thinner A and B horizons than Arenzville and Dunnville soils.

CeA—Caryville loam, 0 to 3 percent slopes. This nearly level and gently sloping soil is on broad stream bottoms and slightly elevated terraces. Most areas are long and narrow and range from 8 to 120 acres in size.

Included with this soil in mapping are small areas

of Arenzville and Dunnville soils. Also included are small areas of Caryville soils that have slopes of more than 3 percent and small areas where the surface layer is sandy loam.

Runoff is slow, and the erosion hazard is slight. This soil is subject to seasonal flooding, but the flooding is generally of short duration and does not significantly limit farming. Low available water capacity limits crop yields during most seasons. Management practices are needed to reduce flooding, maintain organic matter content, and conserve moisture.

Most areas of this soil are used for crops. This soil is suited to all crops commonly grown in the county. It has severe limitations for most nonfarm uses. Capability unit IIIw–12; woodland suitability group 3o1; wildlife group 9; recreation group 3.

Chetek Series

The Chetek series consists of somewhat excessively drained, nearly level to moderately steep, loamy soils underlain by sand and gravel. These soils are on stream terraces and outwash plains. Native vegetation is hardwood and coniferous trees.

In a representative profile the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is dark brown sandy loam about 2 inches thick. The subsoil is about 9 inches thick. The upper 6 inches is dark brown heavy sandy loam, and the lower 3 inches is gravelly loamy sand. The substratum to a depth of about 60 inches is sand and gravel.

Permeability is moderately rapid in these soils. Available water capacity and natural fertility are low.

Most areas of these soils are used for crops. A few areas are wooded or are in permanent pasture. Chetek soils range from moderately well suited to unsuited to cultivated crops. They are well suited to open land wildlife habitat and are suited to woodland. Limitations for most nonfarm uses are slight or moderate.

Representative profile of Chetek sandy loam, 6 to 12 percent slopes, eroded, in an uneroded area in a cultivated field, 1,250 feet east and 600 feet south of the northwest corner of sec. 20, T. 27 N., R. 10 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) when dry; weak fine subangular blocky structure; friable; medium acid; abrupt smooth boundary.

A2—8 to 10 inches; dark brown (10YR 4/3) sandy loam; weak medium platy structure; friable; medium acid; clear smooth boundary.

B2t—10 to 16 inches; dark brown (7.5YR 4/4) heavy sandy loam; moderate medium subangular blocky structure; friable; thin patchy clay films; few fine pebbles; strongly acid; clear smooth boundary.

B3—16 to 19 inches; dark brown (7.5YR 4/4) gravelly loamy sand; weak medium subangular blocky structure; friable; about 30 percent gravel by volume; strongly acid; gradual smooth boundary.

C—19 to 60 inches; yellowish brown (10YR 5/6) sand and gravel; single grained; about 35 percent gravel by volume; loose; medium acid.

Thickness of the solum and depth to sand and gravel ranges from 10 to 20 inches. The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). In places plowing has mixed the A2 horizon with the Ap horizon. The B horizon generally is heavy sandy loam in the upper part and gravelly loamy sand in the lower part. The C horizon generally is sand and gravel. The gravel content is 15 to 35 percent by volume.

Chetek soils formed in material similar to that in which Burkhardt soils formed, but the surface layer of Chetek soils is thinner and lighter colored.

CkB—Chetek sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping soil is on low ridges on outwash plains and stream terraces. Most areas are irregularly shaped and range from 2 to 30 acres in size. This soil has a profile similar to the one described as representative for the series, but it is slightly deeper to the underlying sand and gravel.

Included with this soil in mapping are small areas of Chetek soils that have a surface layer of loam.

Runoff is slow, and the erosion hazard is slight. Low available water capacity limits crop yields during most seasons. Management practices are needed to supply organic matter, conserve moisture, reduce runoff, and control erosion.

Most areas of this soil are used for crops. This soil is moderately well suited to all crops commonly grown in the county. It has slight limitations for most nonfarm uses. Capability unit III–3; woodland suitability group 3d1; wildlife group 4; recreation group 3.

CkC2—Chetek sandy loam, 6 to 12 percent slopes, eroded. This sloping soil is on outwash plains. Most areas are irregularly shaped and range from 8 to 65 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Arland and Elkmound soils.

Runoff is medium, and the erosion hazard is moderate. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion, supply organic matter, conserve moisture, and reduce runoff.

Most areas of this soil are used for crops. Most of the acreage is in hay or pasture. This soil is not well suited to cultivated crops. It has slight or moderate limitations for most nonfarm uses. Capability unit IVe–3; woodland suitability group 3d1; wildlife group 4; recreation group 3.

CkD2—Chetek sandy loam, 12 to 20 percent slopes, eroded. This moderately steep soil is on outwash plains. Most areas are irregularly shaped and range from 6 to 80 acres in size. This soil has a profile similar to the one described as representative for the series, but it is shallower to sand and gravel and has a surface layer that is thinner and, in places, lighter colored.

Included with this soil in mapping are small areas of Arland and Elkmound soils. Also included are areas of severely eroded Chetek soils.

Runoff is rapid, and the erosion hazard is severe. Management practices are needed to maintain plant cover, reduce erosion, and conserve moisture.

Most areas of this soil are in permanent pasture or are planted to pine trees. This soil is generally unsuited to cultivated crops. It has moderate or severe limitations for most nonfarm uses. Capability unit VIe–3; woodland suitability group 3d2; wildlife group 4; recreation group 3.

Curran Series

The Curran series consists of somewhat poorly drained, nearly level, silty soils on stream terraces. These soils are underlain by stratified silt and fine sand. Native vegetation is hardwood trees that require large amounts of water.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 49 inches thick. The upper 6 inches is dark brown, mottled silt loam; the next 5 inches is brown, mottled heavy silt loam; the next 22 inches is grayish brown, mottled silt loam, the lower part of which has a high content of fine sand; and the lower 16 inches is brown, mottled stratified silt and fine sand. The substratum to a depth of about 72 inches is grayish brown stratified medium and fine sand.

Available water capacity and natural fertility are high in these soils. Permeability is moderately slow. In undrained areas these soils are saturated at a depth of 1 to 3 feet during wet periods.

Most areas of these soils are used for crops. A few areas are in woods or permanent pasture. Curran soils are suited to farming if excess water is removed. They are generally poorly suited to woodland. Limitations for many nonfarm uses are severe.

Representative profile of Curran silt loam that has 0 to 2 percent slopes, in a cultivated area, 1,200 feet west and 1,250 feet north of the southeast corner of the SW¼ sec. 9, T. 26 N., R. 7 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) when dry; moderate fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A2—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium platy structure; friable; medium acid; clear smooth boundary.

B1—11 to 17 inches; dark brown (10YR 4/3) silt loam; few fine prominent yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to moderate very fine subangular blocky; friable; strongly acid; clear smooth boundary.

B21t—17 to 22 inches; brown (10YR 5/3) heavy silt loam; many medium faint grayish brown (10YR 5/2), dark yellowish brown (10YR 4/4), and dark brown (7.5YR 4/4) mottles and many medium prominent yellowish brown (10YR 5/6) mottles; weak very thick platy structure parting to moderate fine subangular blocky; firm; thin discontinuous clay films on ped faces; strongly acid; clear smooth boundary.

B22tg—22 to 34 inches; grayish brown (10YR 5/2) heavy silt loam; many medium distinct dark brown (7.5YR 4/4) and brown (7.5YR 5/4) mottles and many medium strong brown (7.5YR 5/6) mottles; weak very thick platy structure parting to moderate fine subangular blocky; firm; thin discontinuous clay films on ped faces; very strongly acid; clear smooth boundary.

IIB31g—34 to 44 inches; grayish brown (10YR 5/2) silt loam with a high content of fine sand; many medium distinct dark brown (7.5YR 4/4) and brown (7.5YR 5/4) mottles and many medium prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

IIB32—44 to 60 inches; brown (7.5YR 5/4) stratified silt and fine sand; many medium faint dark brown (7.5YR 4/4) mottles and many medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; strongly acid; clear smooth boundary.

IIC—60 to 72 inches; grayish brown (10YR 5/2) stratified medium and fine sand; common medium distinct yellowish brown (10YR 5/4) mottles; single grained; loose; medium acid.

Thickness of the solum ranges from 40 to 60 inches. The A2 horizon is pale brown (10YR 6/3) or dark grayish brown (10YR 4/2). The B22g horizon is heavy silt loam or silty clay loam. The IIB3 horizon is silt loam and stratified silt or fine sand. The IIC horizon is sand or loamy sand. In places strata of silt loam are in the IIC horizon.

Curran soils formed in material similar to that in which Dells soils formed. Curran soils formed in stratified medium and fine sand, however, and Dells soils formed in fine sand.

Cu—Curran silt loam (0 to 2 percent slopes). This nearly level soil is in large, regularly shaped areas on stream terraces. Most areas range from 10 to 160 acres in size.

Included with this soil in mapping are small areas of Dells and Lows soils; small areas of Seaton, benches, soils; and small areas of gently sloping Curran soils.

Runoff is slow, and the erosion hazard is slight. This soil received runoff from adjoining areas and is commonly ponded during wet seasons and after heavy rains. Because of the seasonal wetness, tillage generally must be deferred in spring. This soil becomes cloddy if worked when too wet. Surface drainage removes excess water rapidly. Both deep ditches and tile drains are used for internal drainage. Management practices are needed that remove excess water, maintain organic matter content, and improve tilth.

Most areas of this soil are used for crops, but some are used for woodland or wildlife habitat. If properly drained, this soil is suited to most crops commonly grown in the county. It has moderate or severe limitations for many nonfarm uses. Capability unit IIw–2; woodland suitability group 3o2; wildlife group 6; recreation group 5.

Dakota Series

The Dakota series consists of well drained, nearly level and gently sloping, loamy soils that are underlain by sand. These soils are on stream terraces and outwash plains. Native vegetation is tall prairie grasses.

In a representative profile the surface layer is about 16 inches thick. It is very dark brown loam in the upper part and dark yellowish brown loam in the lower part. The subsoil is about 14 inches thick. It is dark brown heavy loam in the upper part and yellowish brown light loam in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand.

Available water capacity is moderate in these soils, and natural fertility is high. Permeability is moderately rapid.

Most areas of these soils are used for crops. A few small areas are in permanent pasture. These soils are suited to farming and to open land wildlife habitat. Limitations for many nonfarm uses are slight or moderate.

Representative profile of Dakota loam, 0 to 3 percent slopes, in a cultivated field, 800 feet south and 50 feet east of the center of sec. 2, T. 27 N., R. 10 W.:

Ap—0 to 10 inches; very dark brown (10YR 2/2) loam; moderate medium subangular blocky structure; friable; slightly acid; abrupt smooth boundary.
A3—10 to 16 inches; dark yellowish brown (10YR 3/4) loam; moderate medium subangular blocky structure; friable; medium acid; clear smooth boundary.
B2t—16 to 25 inches; dark brown (7.5YR 4/4) heavy loam; moderate fine and medium subangular blocky structure; firm; thin patchy clay films; strongly acid; clear smooth boundary.
B3—25 to 30 inches; yellowish brown (10YR 5/4) light loam; weak medium subangular blocky structure; friable; strongly acid; clear smooth boundary.
IIC—30 to 60 inches; yellowish brown (10YR 5/6) sand; single grained; loose; strongly acid.

Thickness of the solum ranges from 20 to 40 inches. The A horizon is black (10YR 2/1) and very dark brown (10YR 2/2). The C horizon ranges in texture from fine to medium sand and is gravelly in places.

Dakota soils are near Burkhardt, Meridian, and Pillot soils. Dakota soils have a finer texture and thicker A and B horizons than Burkhardt soils. They have a thicker and darker colored surface layer than Meridian soils. Unlike Pillot soils, Dakota soils are not silty in the upper part of the solum.

DaA—Dakota loam, 0 to 3 percent slopes. This nearly level and gently sloping soil is on broad stream terraces and outwash plains. Most areas are irregularly shaped and range from 10 to 200 acres in size.

Included with this soil in mapping are a few areas of Dakota soils that have a surface layer of sandy loam and areas where slopes are slightly more than 3 percent.

Runoff is slow, and the erosion hazard is slight. This soil is slightly droughty. Management practices are needed to maintain organic matter content, improve tilth, and conserve moisture.

Most areas of this soil are used for crops. This soil is suited to all crops commonly grown in the county. It has slight or moderate limitations for many nonfarm uses. Capability unit IIs–1; not placed in a woodland suitability group; wildlife group 5; recreation group 1.

Dells Series

The Dells series consists of somewhat poorly drained, nearly level, silty soils that are underlain by sand. These soils are on outwash plains and stream terraces. Native vegetation is mainly oak, maple, and elm.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 8 inches thick. The subsoil is about 19 inches thick. It is brown, mottled silt loam in the upper part and brown, mottled loam in the lower part. The substratum to a depth of about 60 inches is light gray, mottled fine sand.

Available water capacity is moderate, and natural fertility is medium. Permeability is moderate in the subsoil and rapid in the substratum. In undrained areas, these soils are saturated at a depth of 1 to 3 feet during wet periods.

Most areas of these soils are used for crops. A few small areas are in pasture or woods. These soils are suited to farming if adequately drained. They are also suited to woodland and can be used for wildlife habitat. Limitations for most nonfarm uses are severe.

Representative profile of Dells silt loam that has 0 to 2 percent slopes, in a cultivated field, 100 feet north and 500 feet east of the southwest corner of sec. 9, T. 26 N., R. 7 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) when dry; weak medium granular structure; friable; slightly acid; abrupt smooth boundary.
A2—8 to 16 inches; brown (10YR 5/3) silt loam; common fine faint dark yellowish brown (10YR 4/4) mottles; weak thin platy structure; friable; medium acid; clear smooth boundary.
B1—16 to 20 inches; brown (10YR 5/3) silt loam; many medium faint dark brown (7.5YR 4/4) mottles and few medium faint grayish brown (10YR 5/2) mottles; weak thick platy structure parting to weak fine subangular blocky; friable; strongly acid; clear smooth boundary.
B2t—20 to 31 inches; brown (10YR 5/3) silt loam; many medium faint dark brown (7.5YR 4/4) mottles and few medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin patchy clay films; thick light gray (10YR 7/2) silt coatings on ped faces; strongly acid; clear smooth boundary.
IIB3—31 to 35 inches; brown (10YR 5/3) loam; many coarse faint dark brown (7.5YR 4/4) mottles, many coarse prominent strong brown (7.5YR 5/6 and 5/8) mottles, and few coarse distinct gray (10YR 5/1) mottles; weak very thick platy structure parting to weak medium subangular blocky; friable; strongly acid; clear smooth boundary.
IIC—35 to 60 inches; light gray (10YR 7/2) fine sand; many medium prominent dark brown (7.5YR 4/4) mottles; single grained; loose; medium acid.

Thickness of the solum ranges from 20 to 40 inches and typically is the same depth as the loam and silt loam sediment over the sandy C horizon. The Ap horizon ranges from 6 to 10 inches in thickness. The B2t horizon is silt loam or light silty clay loam. The C horizon contains thin loamy bands in places.

Dells soils are near Curran and Shiffer soils. Dells soils have thinner A and B horizons and a thinner mantle of silty material than Curran soils. They have a higher silt content than Shiffer soils.

De—Dells silt loam (0 to 2 percent slopes). This nearly level soil is on outwash plains and stream terraces. Most areas are irregularly shaped and range from 6 to 50 acres in size.

Included with this soil in mapping are small areas of Curran soils.

Runoff is slow, and the erosion hazard is slight. This soil receives runoff from adjoining areas and is commonly ponded during wet seasons and after heavy rains. Because of the seasonal high water table and the lack of slope, this soil generally needs to be tilled one or two weeks later in spring than nearby well drained soils. This soil becomes cloddy if worked when too wet. Surface drainage removes excess water rapidly. Both deep ditches and tile drains are used for internal drainage. Management practices are needed to remove excess water, maintain organic matter content, and improve tilth.

Most areas of this soil are used for crops. If properly drained, this soil is suited to all crops commonly

grown in the county. It has severe limitations for most nonfarm uses. Capability unit IIw–5; woodland suitability group 3o2; wildlife group 6; recreation group 5.

Dunnville Series

The Dunnville series consists of well drained, nearly level and gently sloping, loamy soils underlain by sand. These soils are on stream terraces and outwash plains. Native vegetation is prairie grasses.

In a representative profile the surface layer is about 12 inches thick. It is very dark brown sandy loam in the upper part and dark brown sandy loam in the lower part. The subsoil is about 18 inches thick. It is reddish brown sandy loam in the upper part and dark brown loamy sand in the lower part. The substratum to a depth of about 60 inches is dark brown sand.

Available water capacity and natural fertility are low in these soils. Permeability is moderately rapid.

Most areas of these soils are used for crops. A few small areas are in permanent pasture. Dunnville soils are moderately well suited to farming. They are also suited to open land wildlife habitat and to pine trees. Limitations for many nonfarm uses are slight or moderate.

Representative profile of Dunnville sandy loam, 0 to 3 percent slopes, in a cultivated field, 200 feet north and 500 feet west of the southeast corner of the NE¼ sec. 9, T. 26 N., R. 10 W.:

Ap—0 to 9 inches; very dark brown (10YR 2/2) sandy loam; weak medium granular structure; friable; medium acid; abrupt smooth boundary.

A12—9 to 12 inches; dark brown (7.5YR 3/2) sandy loam; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

B2—12 to 25 inches; reddish brown (5YR 4/3) sandy loam containing slightly more clay than the A12 horizon; weak medium subangular blocky structure; friable; medium acid; clear smooth boundary.

B3—25 to 30 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

C—30 to 60 inches; dark brown (7.5YR 4/4) sand; single grained; loose; medium acid.

Thickness of the solum ranges from 20 to 40 inches, but it is typically about 30 inches. Depth to the outwash sand ranges from 30 to 40 inches. The A horizon is very dark brown (10YR 2/2) and dark brown (7.5YR 3/2).

Dunnville soils are near Billett, Caryville, and Trempe soils. Dunnville soils have a darker colored, thicker A horizon and redder hue in the B and C horizons than Billett soils. They have thicker A and B horizons than Caryville soils. They are finer textured than Trempe soils.

DuA—Dunnville sandy loam, 0 to 3 percent slopes. This nearly level and gently sloping soil is in large, irregularly shaped tracts on stream terraces and outwash plains. Most areas range from 8 to 40 acres in size.

Included with this soil in mapping are small areas of Trempe soils. Also included are areas of Dunnville soils that have a surface layer of loam.

Runoff is slow, and the erosion hazard is slight. Low available water capacity limits crop yields during most seasons. Management practices are needed to supply organic matter, reduce runoff, and conserve moisture.

Nearly all areas of this soil are used for crops. This soil is moderately well suited to all crops commonly grown in the county. It has slight or moderate limitations for many nonfarm uses. Capability unit IIIs–4; woodland suitability group 3o1; wildlife group 1; recreation group 2.

Eleva Series

The Eleva series consists of well drained or somewhat excessively drained, gently sloping to moderately steep, loamy soils on sandstone uplands. These soils are underlain by sandstone at a depth of 20 to 40 inches. Native vegetation is hardwood trees.

In a representative profile the surface layer is very dark grayish brown sandy loam about 7 inches thick. The subsoil is about 18 inches thick. It is mostly brown light loam in the upper 13 inches and yellowish brown light sandy loam in the lower 5 inches. The substratum is 15 inches thick. It is very pale brown and yellowish brown fine sand and weakly cemented yellow sandstone. Below this is yellow hard sandstone that extends to a depth of 60 inches or more.

Available water capacity is low, and natural fertility is medium. Permeability is moderate.

Most areas of these soils are used for crops, but some areas are wooded and others are in permanent pasture. Areas of gently sloping and sloping soils are moderately well suited to farming. Moderately steep soils are not well suited to row crops. These soils are also suited to woodland and wildlife habitat. Limitations for many nonfarm uses are moderate or severe.

Representative profile of Eleva sandy loam, 6 to 12 percent slopes, eroded, 800 feet north and 100 feet west of the southeast corner of the NE¼ sec. 24, T. 26 N., R. 9 W.:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) sandy loam, light brownish gray (10YR 6/2) when dry; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

B1—7 to 9 inches; brown (7.5YR 5/4) sandy loam; weak fine subangular blocky structure; friable; medium acid; abrupt smooth boundary.

B2t—9 to 20 inches; brown (7.5YR 5/4) light loam; moderate medium subangular blocky structure; friable; thin patchy clay films; medium acid; clear smooth boundary.

B3—20 to 25 inches; yellowish brown (10YR 5/6) light sandy loam; weak medium subangular blocky structure; friable; few thin patchy clay films; very strongly acid; clear smooth boundary.

IIC1—25 to 28 inches; very pale brown (10YR 8/3) and yellowish brown (10YR 5/8) fine sand; single grained; loose; strongly acid; gradual smooth boundary.

IIC2—28 to 40 inches; yellow (10YR 7/6) weakly cemented sandstone; strongly acid; abrupt smooth boundary.

R—40 to 60 inches; yellow (10YR 7/6) hard sandstone with layers of soft and weakly cemented sandstone.

Thickness of the solum and depth to sandstone range from 20 to 40 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). In places there is an A2 horizon that is 2 to 4 inches thick. The B2 horizon is sandy loam or loam.

Eleva soils are near Arland, Elkmound, Hixton, and Plainbo soils. Eleva soils, unlike Arland soils, have glacial material in the A and B horizons. They have thicker A and B horizons than Elkmound soils. Eleva soils have a coarser

texture and less clay in the B horizon than Hixton soils, and they have a finer texture and more clay than Plainbo soils.

ElB—Eleva sandy loam, 2 to 6 percent slopes. This gently sloping soil is on narrow ridgetops on sandstone uplands. Most areas are long and narrow and range from 6 to 60 acres in size. This soil has a profile similar to the one described as representative for the series, but it has a slightly thicker surface layer and is deeper to sandstone.

Included with this soil in mapping are small areas of Elkmound and Hixton soils.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. Management practices are needed to supply regular additions of organic matter, conserve moisture, and control erosion and soil blowing.

Most areas of this soil are used for crops and pasture. This soil is moderately well suited to all crops commonly grown in the county. It has moderate or severe limitations for many nonfarm uses. Capability unit IIIs–4; woodland suitability group 3o1; wildlife group 1; recreation group 2.

ElC2—Eleva sandy loam, 6 to 12 percent slopes, eroded. This sloping soil is on narrow ridgetops and hillsides on sandstone uplands. Most areas are long and narrow and range from 5 to 40 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Elkmound and Plainbo soils. Also included are small areas of severely eroded Eleva soils.

Runoff is medium, and the erosion hazard is moderate. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion and soil blowing, reduce runoff, conserve moisture, and supply regular additions of organic matter.

Most areas of this soil are used for crops and pasture. Some areas are in woods. If properly managed, this soil is moderately well suited to all crops commonly grown in the county. It has moderate or severe limitations for many nonfarm uses. Capability unit IIIe–7; woodland suitability group 3o1; wildlife group 1; recreation group 2.

ElD2—Eleva sandy loam, 12 to 20 percent slopes, eroded. This moderately steep soil is on hillsides on sandstone uplands. Most areas are long and narrow and range from 3 to 35 acres in size. This soil has a profile similar to the one described as representative for the series, but it has a thinner and lighter colored surface layer and is slightly shallower to sandstone. In places a few sandstone fragments are on the surface of this soil and throughout the solum.

Included with this soil in mapping are small areas of Elkmound and Plainbo soils. Also included are small areas of severely eroded Eleva soils and a few areas where slopes are as much as 30 percent.

Runoff is rapid, and the erosion hazard is severe. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion and soil blowing, reduce runoff, conserve moisture, and supply regular additions of organic matter.

Some areas of this soil are used for crops, and many areas are used for pasture or woodland. This soil is not well suited to cultivated crops; it is better suited to hay and pasture. It has moderate or severe limitations for many nonfarm uses. Capability unit IVe–7; woodland suitability group 3r1; wildlife group 1; recreation group 2.

Elkmound Series

The Elkmound series consists of well drained, gently sloping to very steep, loamy soils underlain by sandstone bedrock at a depth of less than 20 inches. Native vegetation is hardwood trees.

In a representative profile the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 4 inches of yellowish brown loam that contains platy sandstone fragments. The substratum to a depth of about 16 inches is weathered, platy, fine grained, yellowish brown sandstone that is underlain by pale brown and yellowish brown, firmly cemented fine grained sandstone.

Permeability is moderate in these soils. Available water capacity and natural fertility are low.

Most areas of gently sloping and sloping soils are used for crops. Areas of steeper soils are used for pasture or remain in woods. Gently sloping soils are moderately well suited to cultivated crops if erosion protection is provided. Limitations for most nonfarm uses are moderate or severe.

Representative profile of Elkmound loam, 12 to 20 percent slopes, eroded, in a cultivated area, 900 feet north and 1,000 feet west of the southeast corner of the NE¼ sec. 8, T. 26 N., R. 9 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

B2—8 to 12 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; very friable; many platy sandstone fragments; strongly acid; clear smooth boundary.

C—12 to 16 inches; yellowish brown (10YR 5/6) platy weathered fine grained sandstone; strongly acid; abrupt smooth boundary.

R—16 inches; pale brown (10YR 6/3) and yellowish brown (10YR 5/6) thin bedded firmly cemented fine grained sandstone.

Depth to sandstone ranges from 10 to 20 inches. The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2) and in eroded areas is dark yellowish brown (10YR 4/4). It ranges from 7 to 9 inches in thickness and is loam, sandy loam, or silt loam. The B horizon is 4 to 6 inches thick and is dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/4).

Elkmound soils are near Eleva, Northfield, and Urne soils. Elkmound soils lack the horizon of clay accumulation that Eleva and Northfield soils contain. They lack the glauconitic sandstone that underlies Urne soils.

EmB—Elkmound loam, 2 to 6 percent slopes. This gently sloping soil is on narrow to moderately broad ridgetops. Most areas are long and narrow or irregularly shaped and range from 2 to 35 acres in size. In places sandstone fragments are on the surface of this soil.

Included with this soil in mapping are small areas

of Northfield soils. Also included are small areas of Elkmound soils that have a surface layer of sandy loam.

Runoff is slow, and the erosion hazard is slight. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion, reduce runoff, conserve moisture, maintain organic matter content, and improve tilth.

Most areas of this soil are used for cultivated crops and pasture. This soil is moderately well suited to all crops commonly grown in the county. Capability unit IIIe–3; woodland suitability group 3d1; wildlife group 4; recreation group 3.

EmC2—Elkmound loam, 6 to 12 percent slopes, eroded. This sloping soil is on the tops and side slopes of sandstone ridges. Most areas are long and narrow and range from 6 to 40 acres in size. This soil has a profile similar to the one described as representative for the series, but in places tillage and erosion have brought sandstone fragments to the surface.

Included with this soil in mapping are small areas of Humbird and Northfield soils. Also included are areas of Elkmound soils that have a surface layer of sandy loam and other small areas of Elkmound soils that are severely eroded.

Runoff is medium, and the erosion hazard is moderate. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion, reduce runoff, conserve moisture, and maintain organic matter content and tilth.

Most areas of this soil are now or at one time were used for crops. This soil is not well suited to most cultivated crops commonly grown in the county, but it is suited to hay and pasture. It has moderate or severe limitations for most nonfarm uses. Capability unit IVe–3; woodland suitability group 3d1; wildlife group 4; recreation group 3.

EmD2—Elkmound loam, 12 to 20 percent slopes, eroded. This moderately steep soil is on sides of sandstone ridges. Most areas are long and narrow and range from 6 to 60 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Northfield and Plainbo soils. Also included are areas of Elkmound soils that have a surface layer of sandy loam and other small areas of Elkmound soils that are severely eroded.

Runoff is rapid, and the erosion hazard is severe. Low available water capacity and severe erosion hazard make this soil generally unsuited to cultivated crops. Management practices are needed to maintain plant cover and reduce erosion.

Most areas of this soil are in permanent pasture or woods. Some areas are used mainly for hay. This soil is generally unsuited to cultivated crops, but is better suited to hay or pasture. It has moderate or severe limitations for many nonfarm uses. Capability unit VIe–3; woodland suitability group 3d2; wildlife group 4; recreation group 3.

EmE—Elkmound loam, 20 to 45 percent slopes. This steep and very steep soil is on sides of sandstone ridges. Most areas are long and narrow and range from 10 to 200 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer and subsoil are thinner. Sandstone fragments are common on the surface.

Included with this soil in mapping are small areas of Northfield and Plainbo soils. Also included are areas of Elkmound soils that have a surface layer of sandy loam and other small areas of Elkmound soils that are severely eroded.

Runoff is very rapid, and the erosion hazard is very severe. Management practices are needed to maintain plant cover and reduce erosion.

Most areas of this soil are in grasses or trees. This soil is not suited to cultivated crops. It has severe limitations for most nonfarm uses. Capability unit VIIe–3; woodland suitability group 3d2; wildlife group 4; recreation group 3.

Elm Lake Series

The Elm Lake series consists of poorly drained, nearly level soils in depressions and along drainageways on sandstone uplands. These soils formed in residuum weathered from sandstone that is interbedded with shale in some areas. Native vegetation is grasses, sedges, shrubs, and trees that require large amounts of water.

In a representative profile the surface layer is black loamy sand about 1 inch thick. The substratum to a depth of about 60 inches is brown and grayish brown, mottled loamy sand in the upper 6 inches; pale brown, mottled sand in the next 20 inches; gray, mottled loam in the next 9 inches; and light gray, very pale brown, and brownish yellow soft sandstone below.

Permeability is moderately rapid in the upper sandy part of these soils and slow below. Available water capacity and natural fertility are low. In undrained areas, ground water is at or near the surface throughout the year.

Most areas of these soils remain in woods. Small areas are cleared for pasture and crops. Wetness and frost hazard are limitations for farming. Elm Lake soils are well suited to wetland wildlife habitat. Limitations for most nonfarm uses are moderate or severe.

Representative profile of Elm Lake loamy sand that has 0 to 2 percent slopes, in a wooded area, 200 feet south and 100 feet west of the northeast corner of sec. 35, T. 25 N., R. 5 W.:

A1—0 to 1 inch; black (10YR 2/1) loamy sand; weak medium granular structure; very friable; very strongly acid; abrupt smooth boundary.

C1—1 inch to 4 inches; brown (10YR 5/3) loamy sand; few fine faint grayish brown (10YR 5/2) mottles and common fine faint dark brown (7.5YR 4/4) mottles; weak thin platy structure; very friable; strongly acid; clear wavy boundary.

C2—4 to 7 inches; grayish brown (10YR 5/2) loamy sand; common medium distinct dark brown (7.5YR 4/4) mottles; single grained; very friable; strongly acid; clear wavy boundary.

C3—7 to 27 inches; pale brown (10YR 6/3) sand; many medium distinct dark yellowish brown (10YR 4/4) mottles; single grained; loose; medium acid; clear smooth boundary.

IIC4—27 to 36 inches; gray (5Y 5/1) loam; many medium prominent dark brown (7.5YR 4/4) and strong

brown (1.5YR 5/8) mottles; massive; firm; very strongly acid; clear smooth boundary.

IIC5—36 to 60 inches; light gray (10YR 7/2), very pale brown (10YR 7/3), and brownish yellow (10YR 6/6) soft sandstone; medium acid.

Thickness of the solum and depth to sandstone range from 30 to 50 inches. The A1 horizon is black (10YR 2/1) or very dark grayish brown (10YR 3/2) and ranges from 1 to 6 inches in thickness. It is generally sand, loamy sand, or light sandy loam, but in places it is a thin layer of peat or muck. The C horizon is loamy sand or sand and ranges from 15 to 36 inches in thickness. The IIC4 horizon is loam, light silty clay loam, silty clay, sandy clay loam, or clay loam and ranges from 4 to 6 inches in thickness. The IIC5 horizon is sandstone that contains strata of shale in places.

Elm Lake soils formed in material similar to that in which Fairchild soils formed, and they have drainage similar to that of Newson soils. Elm Lake soils are poorly drained, and Fairchild soils are somewhat poorly drained. Elm Lake soils are underlain by sandstone that in places contains layers of shale, and Newson soils formed in sandy outwash.

Eo—Elm Lake loamy sand (0 to 2 percent slopes). This nearly level soil is along drainageways and in depressions on sandstone uplands. Most areas are long and narrow and range from 10 to 200 acres in size.

Included with this soil in mapping are small areas of Fairchild, Markey, and Newson soils. Also included are areas of Elm Lake soils that have a surface layer of sand or light sandy loam.

Runoff is slow, and the erosion hazard is slight. This soil received runoff from adjoining areas and is commonly ponded during wet seasons and after heavy rains. Surface drainage removes excess water rapidly. Deep ditches are used for internal drainage. In overdrained areas low available water capacity limits crop yields during most seasons. Crops grown on this soil are subject to frost damage. Management practices are needed to remove excess water, maintain organic matter content, and control acidity levels.

Most areas of this soil remain in woods. Some small areas are cleared and used for pasture and crops. This soil is not well suited to cultivated crops, but is well suited to wetland wildlife habitat. This soil has moderate or severe limitations for most nonfarm uses. Capability unit IVw–5; woodland suitability group 4w1; wildlife group 7; recreation group 6.

Ettrick Series

The Ettrick series consists of poorly drained and very poorly drained, nearly level, silty soils on stream bottoms and in depressions. Native vegetation is grasses, sedges, reeds, and other plants that require large amounts of water.

In a representative profile the surface layer is black silt loam about 12 inches thick. The subsoil is about 20 inches thick. It is dark gray light silty clay loam in the upper part and gray silt loam in the lower part. The substratum to a depth of about 60 inches is stratified gray silt and very fine sand.

Available water capacity and natural fertility are high in these soils. Permeability is moderately slow. In undrained areas, ground water is at or near the surface throughout the year.

Some areas of these soils are used for crops, but many areas are in native grasses and shrubs. Ettrick soils are suited to crops if excess water is removed. If they are drained, they are well suited to open land wildlife habitat. These soils are poorly suited to woodland. Limitations for nonfarm uses are severe.

Representative profile of Ettrick silt loam that has 0 to 2 percent slopes, in a cultivated field, 850 feet south and 800 feet east of the northwest corner of the SW¼ sec. 9, T. 26 N., R. 7 W.:

Ap—0 to 9 inches; black (N 2/0) silt loam; weak medium subangular blocky structure; friable; medium acid; abrupt smooth boundary.

A12—9 to 12 inches; black (10YR 2/1) heavy silt loam; moderate medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

B2tg—12 to 26 inches; dark gray (5Y 4/1) light silty clay loam; few medium prominent dark yellowish brown (10YR 4/4) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; firm; thin patchy clay films and organic stains on ped faces; slightly acid; clear smooth boundary.

B3g—26 to 32 inches; gray (5Y 5/1) silt loam; few medium prominent dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; dark brown (7.5YR 4/4) iron and organic coatings in old root channels; slightly acid; clear smooth boundary.

IICg—32 to 60 inches; gray (5Y 5/1) silt with strata of very fine sand; massive; friable; neutral.

Thickness of the solum ranges from 24 to 36 inches. The A horizon ranges from about 12 to 18 inches in thickness. The B2t horizon ranges from dark gray (5Y 4/1 and 10YR 4/1) to very dark gray (10YR 3/1). Thickness of the B2t horizon ranges from 8 to 15 inches.

Ettrick soils are near Orion and Lows soils and formed in material similar to that in which Otter soils formed. Ettrick soils have a thicker and blacker A horizon than Orion and Lows soils and a more highly gleyed B horizon than Lows soils. Unlike Otter soils, they have a Bt horizon.

Er—Ettrick silt loam (0 to 2 percent slopes). This nearly level soil is along drainageways and in depressions. Most areas are irregularly shaped and range from 20 to 60 acres in size.

Included with this soil in mapping are small areas where a light colored silty overwash is on the surface.

Runoff is very slow or ponded, and the erosion hazard is slight. This soil receives runoff from adjoining areas and is subject to flooding. Because of wetness, this soil generally must be tilled about two weeks later in spring than nearby, better drained soils. Surface drainage removes excess water rapidly. Deep ditches and tile drains are used for internal drainage. Management practices are needed to remove excess water, maintain organic matter content, and improve tilth.

About half of the acreage of this soil is drained and used for crops. Other areas have a shrub or grass cover. If drained, this soil is highly productive and is suited to most crops commonly grown in the county. It has severe limitations for most nonfarm uses. Capability unit IIw–1; woodland suitability group 4w2; wildlife group 7; recreation group 6.

Fairchild Series

The Fairchild series consists of somewhat poorly drained, nearly level and gently sloping soils on

uplands. These soils are underlain by sandstone and shale bedrock at a depth of 20 to 40 inches. Native vegetation is oak, aspen, and white birch.

In a representative profile the surface layer is black loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 9 inches thick. The upper part of the subsoil is dark brown loamy fine sand about 9 inches thick. Below this is about 14 inches of pale brown, mottled sand. The lower part of the subsoil is light olive brown, mottled loam about 7 inches thick. The substratum to a depth of about 60 inches is very pale brown, mottled sandstone that has thin layers of light olive brown shale.

Permeability is rapid in the upper part of these soils and moderately slow in the lower part. Available water capacity and natural fertility are low. In undrained areas these soils are saturated at a depth of 1 to 3 feet during wet periods.

Fairchild soils are suited to farming if excess water is removed. Most areas of these soils remain in woods and are used for wildlife habitat. Limitations for nonfarm uses are moderate or severe.

In this county Fairchild soils are mapped only in association with Merrillan soils.

Representative profile of Fairchild loamy sand in a wooded area of Fairchild and Merrillan soils, 0 to 2 percent slopes, 150 feet north and 100 feet west of the southeast corner of sec. 3, T. 25 N., R. 5 W.:

A1—0 to 1 inch; black (10YR 2/1) loamy sand; weak fine granular structure; very friable; many roots; few white (10YR 8/2) sand grains; very strongly acid; abrupt smooth boundary.

A2—1 inch to 10 inches; pinkish gray (7.5YR 6/2) loamy sand; single grained; loose; many roots; very strongly acid; abrupt wavy boundary.

B21hir—10 to 13 inches; dark brown (7.5YR 3/2) loamy fine sand; few medium distinct dark yellowish brown (10YR 4/4) and brown (10YR 5/3) mottles; weak fine subangular blocky structure; very friable; many roots; strongly acid; clear wavy boundary.

B22ir—13 to 19 inches; dark brown (7.5YR 4/4) loamy fine sand; few medium faint dark yellowish brown (10YR 4/4) and brown (10YR 5/3) mottles; weak fine subangular blocky structure; very friable; few roots; strongly acid; clear wavy boundary.

A'2—19 to 33 inches; pale brown (10YR 6/3) sand; many medium prominent strong brown (7.5YR 5/6) mottles and many medium faint brown (10YR 5/3) and light brownish gray (10YR 6/2) mottles; single grained; loose; medium acid; clear smooth boundary.

IIB'2t—33 to 40 inches; light olive brown (2.5Y 5/4) loam; many medium faint dark yellowish brown (10YR 4/4) mottles and many medium distinct brownish yellow (10YR 6/6) and light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; few thin discontinuous clay films on ped faces; very strongly acid; clear smooth boundary.

IIIC—40 to 60 inches; very pale brown (10YR 7/3) soft sandstone with thin layers of light olive brown (2.5Y 5/4) shale; many coarse prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; very strongly acid.

Thickness of the solum and depth to sandstone range from 30 to 50 inches. The A1 or Ap horizon is black (10YR 2/1) or very dark grayish brown (10YR 3/2) and is 1 inch to 5 inches thick. The A2 horizon is pinkish gray (7.5YR 6/2) or light brown (7.5YR 6/4) and is 7 to 12 inches thick. In places the A2 horizon is missing because it has been mixed into the Ap horizon. The B21hir horizon is dark reddish brown (5YR 3/4) or dark brown (7.5YR 3/2) loamy sand or loamy fine sand and ranges from 6 to 13 inches in thickness.

The A'2 horizon is pale brown (10YR 6/3) or brown (10YR 5/3) sand or loamy sand and ranges from 7 to 13 inches in thickness. The IIB'2t horizon ranges from 4 to 10 inches in thickness. It is dark grayish brown (10YR 4/2), light olive brown (2.5Y 5/4), or pale olive (5Y 6/4). The C horizon has a wide range in texture, reflecting the interlayering of sandstone and shale.

Fairchild soils formed in material similar to that in which Elm Lake, Ludington, and Merrillan soils formed. Fairchild soils are somewhat poorly drained, Elm Lake soils are poorly drained, and Ludington soils are well drained and moderately well drained. Fairchild soils contain more sand and less clay throughout the A and B horizons than Merrillan soils.

FmA—Fairchild and Merrillan soils, 0 to 2 percent slopes. These somewhat poorly drained, nearly level soils are on uplands where sandstone and shale bedrock are relatively shallow. Most areas are large and irregularly shaped and range from 20 to 140 acres in size.

In places this undifferentiated group consists of both Fairchild and Merrillan soils, and in other places it consists of one soil or the other. The Fairchild soil in this unit has the profile described as representative for its series.

Included with these soils in mapping are small areas of Elm Lake, Humbird, and Ludington soils.

Runoff is slow, and the erosion hazard is slight. Lime is needed in areas where the soils have not been previously limed. Management practices are needed to remove excess water.

Most areas of these soils remain in woods. Some areas are cleared and used for pasture or crops. If they are properly limed and excess water is removed, these soils are suited to crops. They have moderate or severe limitations for most nonfarm uses. Capability unit IIIw–6; woodland suitability group 3s2; wildlife group 6; recreation group 5.

FmB—Fairchild and Merrillan soils, 2 to 6 percent slopes. These somewhat poorly drained, gently sloping soils are on uplands where sandstone and shale bedrock are relatively shallow. Most areas are irregularly shaped and range from 20 to 100 acres in size.

In places this undifferentiated group consists of both Fairchild and Merrillan soils, and in other places it consists of one soil or the other. The Merrillan soil has the profile described as representative for its series.

Included with these soils in mapping are small areas of Elm Lake, Humbird, and Ludington soils.

Runoff is slow to medium, and the erosion hazard is slight. Lime is needed in areas where the soils have not been previously limed. Management practices are needed to remove excess water.

Most areas of these soils remain in woods, but some areas are used for pasture or crops. If excess water is removed, these soils are suited to crops commonly grown in the county. They have moderate or severe limitations for most nonfarm uses. Capability unit IIIw–6; woodland suitability group 3s2; wildlife group 6; recreation group 5.

Fallcreek Series

The Fallcreek series consists of somewhat poorly drained, nearly level and gently sloping, loamy soils on glacial till plains. Native vegetation is hardwood trees.

In a representative profile the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer is about 8 inches thick. It is brown, mottled sandy loam in the upper part and grayish brown, mottled sandy loam in the lower part. The subsoil is about 26 inches thick. It is pale brown, mottled loam in the upper part and reddish brown, mottled loam in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled loam.

Available water capacity is high in these soils, and natural fertility is medium. Permeability is moderately rapid in the upper part of the soil and moderately slow in the lower part. In undrained areas, these soils are saturated at a depth of 1 to 3 feet during wet periods.

Some areas of these soils are used for crops and pasture. Other areas are used for woodland and wildlife habitat. Fallcreek soils are suited to farming if excess water is removed and erosion is controlled. They are also suited to woodland and wildlife habitat. Limitations for many nonfarm uses are severe.

Representative profile of Fallcreek sandy loam, 2 to 6 percent slopes, in a cultivated area, 850 feet north and 50 feet east of the center of sec. 7, T. 27 N., R. 5 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) when dry; weak fine subangular blocky structure; friable; medium acid; abrupt smooth boundary.

A2—8 to 12 inches; brown (10YR 5/3) sandy loam; common medium faint grayish brown (10YR 5/2) and dark brown (7.5YR 4/4) mottles; weak thin platy structure; friable; medium acid; clear wavy boundary.

A&B—12 to 16 inches; grayish brown (10YR 5/2) sandy loam (A2); common medium faint light brownish gray (10YR 6/2) mottles, common medium distinct dark brown (7.5YR 4/4) mottles, and common medium prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; pale brown (10YR 6/3) loam (B2t) extensions make up about 35 percent of the horizon; few pebbles; strongly acid; clear wavy boundary.

B&A—16 to 22 inches; pale brown (10YR 6/3) loam (B2t); many medium faint grayish brown (10YR 5/2) mottles and many medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; light brownish gray (10YR 6/2) sandy loam tongues (A2) extend into this horizon and make up about 35 percent of the horizon; few pebbles; strongly acid; clear wavy boundary.

B2t—22 to 34 inches; reddish brown (5YR 4/4) heavy loam; many medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; many thin clay films on ped faces; thick light gray (10YR 7/2) very fine sand coatings on prism faces; many pebbles; very strongly acid; clear smooth boundary.

B3t—34 to 42 inches; reddish brown (5YR 4/4) light loam; common medium faint dark brown (7.5YR 4/4) mottles and common medium distinct yellowish red (5YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; friable; few thin discontinuous clay films on ped faces; thin very fine sand and silt coatings on prism faces; few to many pebbles; very strongly acid; gradual smooth boundary.

C—42 to 60 inches; reddish brown (5YR 4/4) loam; few medium faint dark brown (7.5YR 4/4) mottles; weak very thick platy structure in upper part, becoming massive in lower part; firm; few to many pebbles; slightly acid.

Thickness of the solum ranges from 30 to 48 inches. The upper part of the solum is sandy loam and ranges from 10 to 24 inches in thickness. In places the A1, Ap, and A2g horizons are loam. In uncultivated areas, the A1 horizon ranges from 2 to 4 inches in thickness and is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). The A2 horizon is brown (10YR 5/3), grayish brown (10YR 5/2), or pale brown (10YR 6/3). The B2t horizon is loam, sandy clay loam, or light clay loam. The B3 and C horizons are loam, heavy sandy loam, or sandy clay loam.

Fallcreek soils are near Fallcreek variant soils. Fallcreek soils are somewhat poorly drained, and Fallcreek variant soils are moderately well drained.

FoA—Fallcreek sandy loam, 0 to 2 percent slopes. This nearly level soil is in depressions on glacial till plains. Most areas are irregularly shaped and range from 20 to 100 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer in this soil is thicker than the one in the representative profile.

Included with this soil in mapping are small areas of Fallcreek variant soils and Humbird and Merrillan soils.

Runoff is slow, and the erosion hazard is slight. This soil receives runoff from adjoining areas and is subject to ponding in some areas during wet seasons and after heavy rains. Because of wetness, this soil is generally tilled about 10 days later in spring than nearby, better drained soils. Surface drainage removes excess water rapidly. Both deep ditches and tile drains are used for internal drainage. Management practices are needed to remove excess water and maintain organic matter content.

About one-third of the acreage of this soil is used for crops. The rest is used for pasture, woodland, or wildlife habitat. This soil is suited to most crops commonly grown in the county. Capability unit IIw–4; woodland suitability group 2o2; wildlife group 6; recreation group 5.

FoB—Fallcreek sandy loam, 2 to 6 percent slopes. This gently sloping soil is along drainageways and in depressions on glacial till plains. Most areas are long and narrow and range from 30 to 300 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Fallcreek variant soils and Humbird and Merrillan soils.

Runoff is slow or medium, and the erosion hazard is slight or moderate. This soil receives runoff from adjoining areas and remains wet during wet seasons and after heavy rains. Because of wetness, this soil is generally tilled about 10 days later in spring than nearby better drained soils. Surface drainage removes excess water rapidly. Both deep ditches and tile drains are used for internal drainage. Management practices

are needed to remove excess water, maintain organic matter content, and control erosion.

About one-third of the acreage of this soil is used for crops. The rest is used for pasture, woodland, or wildlife habitat. This soil is suited to most crops commonly grown in the county. It has severe limitations for many nonfarm uses. Capability unit IIw–4; woodland suitability group 2o2; wildlife group 6; recreation group 5.

Fallcreek Variant

The Fallcreek variant soils are moderately well drained and gently sloping and sloping. They are on glacial till plains. Native vegetation is hardwood forest consisting mainly of northern red oak, sugar maple, and basswood.

In a representative profile the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 7 inches thick. The subsoil is reddish brown, firm, mottled heavy loam about 33 inches thick. Below this to a depth of about 60 inches is reddish brown heavy loam.

Available water capacity is high in these soils, and natural ferility is medium. Permeability is moderately slow. During wet periods many areas of these soils are saturated at a depth of 3 to 5 feet.

Most areas of these soils are used for crops. A few areas are in pasture or woods. These soils are well suited or moderately well suited to farming if erosion is controlled. They are also suited to pasture and woodland. Limitations for most nonfarm uses are moderate.

Representative profile of Fallcreek loam, moderately well drained variant, 6 to 12 percent slopes, in a cultivated area; 700 feet north and 50 feet west of the southeast corner of the NE¼ sec. 3, T. 27 N., R. 5 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A2—8 to 10 inches; brown (10YR 5/3) loam; weak thin platy structure; friable; medium acid; abrupt wavy boundary.

A&B—10 to 15 inches; brown (10YR 5/3) tongues of loam (A2) make up about 60 percent of the matrix; weak thin platy structure; reddish brown (5YR 4/3) loam (B2t); moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin clay films and light gray (10YR 7/1) very fine sand coatings on ped faces; strongly acid; abrupt wavy boundary.

B&A—15 to 30 inches; reddish brown (5YR 4/3) loam (B2t); moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin clay films and light gray (10YR 7/1) very fine sand coatings on ped faces; brown (10YR 5/3) tongues of loam (A2) make up about 20 percent of the matrix; weak thin platy structure; strongly acid; abrupt wavy boundary.

B2t—30 to 42 inches; reddish brown (5YR 4/4) heavy loam; few medium faint dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin clay films and light gray (10YR 7/1) very fine sand coatings on ped faces; strongly acid; clear smooth boundary.

B3t—42 to 48 inches; reddish brown (5YR 4/4) heavy loam; few medium faint dark brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; firm; thin discontinuous clay films on ped faces; medium acid; gradual smooth boundary.

C—48 to 60 inches; reddish brown (5YR 4/4) heavy loam; massive; firm; medium acid.

Thickness of the solum ranges from 30 to 50 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). In uncultivated areas the A1 horizon is very dark gray (10YR 3/1) or black (10YR 2/1). The A2 horizon is grayish brown (10YR 5/2) or brown (10YR 5/3). The A&B and B&A horizons vary in thickness and have the same colors as the A2 and B2t horizons. The B2t, B3t, and C horizons are loam or clay loam and have few to many pebbles.

Fallcreek variant soils are near Fallcreek and Otterholt soils. The Fallcreek variants lack the mottling in the A2 and A&B horizons of the Fallcreek soils. Unlike Otterholt soils which formed in silt loam, the Fallcreek variants formed in loam.

FpB—Fallcreek loam, moderately well drained variant, 2 to 6 percent slopes. This gently sloping soil is on glacial till plains. Most areas are irregularly shaped and range from 6 to 45 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer is slightly thicker and darker colored.

Included with this soil in mapping are small areas of Fallcreek soils and areas of Fallcreek moderately well drained variants that have a surface layer of sandy loam.

Runoff is medium, and the erosion hazard is slight to moderate. Management practices are needed to control erosion and reduce runoff.

Most areas of this soil are used for crops, but some areas remain in woods. If erosion is controlled, this soil is well suited to farming. It has moderate limitations for most nonfarm uses. Capability unit IIe–1; woodland suitability group 2o2; wildlife group 1; recreation group 1.

FpC—Fallcreek loam, moderately well drained variant, 6 to 12 percent slopes. This sloping soil is on side slopes on glacial till plains. Most areas are irregularly shaped. They range from 10 to 60 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Fallcreek soils and areas of Fallcreek moderately well drained variant that have a surface layer of sandy loam. Also included are stony areas that are indicated by stone spot symbols on the soil map.

Runoff is medium to rapid, and the erosion hazard is moderate. Management practices are needed to control erosion and reduce runoff.

Most areas of this soil are used for crops, but some areas remain in woods. If erosion is controlled, this soil is moderately well suited to farming. It has moderate limitations for most nonfarm uses. Capability unit IIIe–1; woodland suitability group 2o2; wildlife group 1; recreation group 1.

Friendship Series

The Friendship series consists of moderately well drained, nearly level and gently sloping soils on stream terraces and outwash plains. Native vegetation is mixed hardwoods and conifers.

In a representative profile the surface layer is very

dark grayish brown loamy sand about 9 inches thick. The subsoil is about 19 inches thick. It is dark brown loamy sand in the upper 9 inches; dark yellowish brown medium sand in the next 4 inches; and brown, mottled medium and fine sand in the lower 6 inches. The substratum to a depth of about 60 inches is yellowish brown, mottled medium and fine sand.

Available water capacity and natural fertility are low in these soils. Permeability is rapid. During wet periods these soils are saturated at a depth of 3 to 5 feet.

Most areas of these soils are in woods. Some areas have been cleared for crops and pasture. These soils are not well suited to crops, but yields are higher if irrigation is provided. These soils are suited to pasture, woodland, and wildlife habitat. Limitations for nonfarm uses are slight to severe.

Representative profile of Friendship loamy sand, 0 to 3 percent slopes, in a cultivated area, 150 feet north and 500 feet west of the southeast corner of sec. 22, T. 27 N., R. 8 W.:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) when dry; weak fine subangular blocky structure; very friable; medium acid; abrupt smooth boundary.

B1—9 to 18 inches; dark brown (10YR 4/3) loamy sand; very weak medium subangular blocky structure; very friable; medium acid; clear smooth boundary.

B2—18 to 22 inches; dark yellowish brown (10YR 4/4) medium sand; very weak medium subangular blocky structure; very friable; strongly acid; clear smooth boundary.

B3—22 to 28 inches; brown (10YR 5/3) medium and fine sand; few fine prominent strong brown (7.5YR 5/6) mottles; very weak coarse subangular blocky structure, single grained where disturbed; very friable to loose; strongly acid; gradual smooth boundary.

C1—28 to 46 inches; yellowish brown (10YR 5/4) medium and fine sand; common medium prominent yellowish red (5YR 5/8) mottles; single grained; loose; strongly acid; gradual smooth boundary.

C2—46 to 60 inches; light yellowish brown (10YR 6/4) medium and fine sand; single grained; loose; strongly acid.

Thickness of the solum ranges from 20 to 40 inches. The Ap horizon is very dark grayish brown (10YR 3/2), brown (10YR 4/3), or dark grayish brown (10YR 4/2). Distinct or prominent high chroma mottles are few or common at a depth of 22 to about 46 inches.

Friendship soils formed in material similar to that in which Menahga, Morocco, Newson, and Plainfield soils formed. Friendship soils have a seasonal water table at a shallower depth than the seasonal water tables in Menahga and Plainfield soils and at a greater depth than the seasonal water tables in Newson and Morocco soils.

FrA—Friendship loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 2 to 35 acres in size.

Included with this soil in mapping are a few small areas of Menahga and Morocco soils. Also included are areas of Friendship soils that have thin loamy bands below a depth of 40 inches.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. Management practices are needed to supply regular additions of organic matter, conserve moisture, and control soil blowing.

Less than half of the acreage of this soil is used for crops. The rest is in grasses or hardwood trees. A few areas have been planted to pine trees. This soil is used for most crops commonly grown in the county. Deep-rooted crops, such as alfalfa, benefit from the seasonal high water table. This soil is suited to irrigation and, if irrigated, it can be more intensively cropped. It has slight to severe limitations for nonfarm uses. Capability unit IVs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

Gale Series

The Gale series consists of well drained, gently sloping to steep, loamy soils on sandstone uplands. Native vegetation is mixed hardwoods, mainly oak, elm, maple, and basswood.

In a representative profile the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 24 inches thick. It is brown and dark yellowish brown silt loam in the upper part and yellowish brown loam in the lower part. The substratum to a depth of about 41 inches is light gray and pale brown sand over weakly cemented sandstone. It is underlain by hard sandstone that contains layers of soft and weakly cemented sandstone and extends to a depth of 60 inches or more.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderate.

Most areas of gently sloping and sloping soils are used for crops. Areas of steeper soils are in pasture or woods or are used for wildlife habitat. Limitations for many nonfarm uses are moderate or severe.

Representative profile of Gale silt loam, 12 to 20 percent slopes, eroded, in a cultivated field, 300 feet west and 200 feet north of the center of sec. 36, T. 25 N., R. 10 W.:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) when dry; weak medium subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

B1—7 to 13 inches; brown (10YR 5/3) silt loam; weak thick platy structure parting to weak fine subangular blocky; friable; thin light gray (10YR 7/2) silt coatings on ped faces; medium acid; clear smooth boundary.

B2t—13 to 26 inches; dark yellowish brown (10YR 4/4) heavy silt loam; moderate medium subangular blocky structure; firm; thin patchy clay films; thin light gray (10YR 7/2) silt coatings on ped faces; strongly acid; clear smooth boundary.

IIB3—26 to 31 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; thin patchy clay films; thin light gray (10YR 7/2) silt coatings on ped faces; strongly acid; clear smooth boundary.

IIC1—31 to 38 inches; light gray (10YR 7/2) and pale brown (10YR 6/3) sand; single grained; loose; medium acid; gradual smooth boundary.

IIC2—38 to 41 inches; weakly cemented light brownish gray (10YR 6/2) and yellow (10YR 7/6) sandstone; medium acid; abrupt smooth boundary.

R—41 to 60 inches; hard sandstone that has layers of soft and weakly cemented sandstone.

Thickness of the solum ranges from 20 to 40 inches. and thickness of the silt loam mantle ranges from 15 to 34 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). The IIB3 horizon is sandy loam or loam.

Gale soils are near Norden, Northfield, and Seaton soils. Gale soils are underlain by nonglauconitic sandstone and Norden soils by glauconitic sandstone. Gale soils are deeper to sandstone than Northfield soils, but they are not as thick as Seaton soils.

GaB—Gale silt loam, 2 to 6 percent slopes. This gently sloping soil is on ridgetops on sandstone uplands. Most areas are long and narrow or irregularly shaped and range from 4 to 60 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer and subsoil in this soil are thicker than the ones in the representative profile.

Included with this soil in mapping are small areas of Hixton and Northfield soils.

Runoff is medium, and the erosion hazard is slight or moderate. Management practices are needed to maintain organic matter content and tilth, conserve moisture, reduce runoff, and control erosion.

Most areas of this soil are used for crops. This soil is well suited to all crops commonly grown in the county. It has moderate or severe limitations for many nonfarm uses. Capability unit IIe–2; woodland suitability group 2o1; wildlife group 1; recreation group 1.

GaC2—Gale silt loam, 6 to 12 percent slopes, eroded. This sloping soil is on the tops and sides of ridges on sandstone uplands. Most areas are long and narrow and range from 5 to 50 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer in this soil is slightly lighter colored than the one in the representative profile.

Included with this soil in mapping are small areas of Hixton and Northfield soils. Also included are some areas of severely eroded Gale soils.

Runoff is medium, and the erosion hazard is moderate. Management practices are needed to maintain organic matter content and tilth, conserve moisture, reduce runoff, and control erosion.

Most areas of this soil are used for crops. This soil is moderately well suited to all crops commonly grown in the county. It has moderate or severe limitations for many nonfarm uses. Capability unit IIIe–2; woodland suitability group 2o1; wildlife group 1; recreation group 1.

GaD2—Gale silt loam, 12 to 20 percent slopes, eroded. This sloping soil is on the tops and sides of ridges on sandstone uplands. Most areas are long and narrow and range from 5 to 35 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Hixton and Northfield soils. Also included are small areas of severely eroded Gale soils.

Runoff is rapid, and the erosion hazard is severe. Management practices are needed to control erosion, reduce runoff, conserve moisture, and maintain organic matter content and tilth.

Much of this soil is used for crops, mainly hay. Some areas are in grass and trees. This soil is not well suited to cultivated crops commonly grown in the county. It is suited to pasture, woodland, and wildlife habitat. It has severe limitations for most nonfarm uses. Capability unit IVe–2; woodland suitability group 2r1; wildlife group 1; recreation group 1.

GaE—Gale silt loam, 20 to 30 percent slopes. This steep soil is on hillsides on sandstone uplands. Most areas are long and narrow and range from 5 to 45 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer in this soil is slightly thinner and lighter colored than the one in the representative profile.

Included with this soil in mapping are small areas of Hixton and Northfield soils. Also included are small areas of severely eroded Gale soils.

Runoff is very rapid, and the erosion hazard is very severe. Management practices are needed to maintain plant cover, control erosion, and reduce runoff.

Most areas of this soil are in grass or trees. This soil is generally unsuited to cultivated crops, but it is suited to pasture. Controlled grazing and proper renovation practices help to maintain good yields. This soil is also used for woodland and wildlife habitat. It has severe limitations for nonfarm uses. Capability unit VIe–2; woodland suitability group 2r1; wildlife group 1; recreation group 1.

Gotham Series

The Gotham series consists of somewhat excessively drained, nearly level to sloping, sandy soils on stream terraces and outwash plains. Native vegetation is prairie grasses and scattered hardwood trees.

In a representative profile the surface layer is very dark grayish brown loamy fine sand about 8 inches thick. The subsoil is about 20 inches thick. It is dark yellowish brown heavy loamy fine sand in the upper 10 inches and yellowish brown loamy fine sand in the lower 10 inches. The substratum to a depth of about 60 inches is light yellowish brown fine and medium sand.

Available water capacity and natural fertility are low in these soils. Permeability is rapid.

Most areas of these soils are used for crops. A few areas are in permanent pasture or are planted to pine trees. Some areas in and around urban areas are used for commercial or home building sites. These soils are not well suited to most crops commonly grown in the county. Limitations for most nonfarm uses are slight or moderate.

Representative profile of Gotham loamy sand, 1 to 6 percent slopes, in a cultivated field, 50 feet north and 600 feet west of the southeast corner of sec. 1, T. 26 N., R. 9 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) when dry; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

B2t—8 to 18 inches; dark yellowish brown (10YR 4/4) heavy loamy fine sand; weak medium subangular blocky structure; friable; clay bridging between sand grains; slightly acid; clear smooth boundary.

B3—18 to 28 inches; yellowish brown (10YR 5/6) loamy fine sand; weak medium subangular blocky structure; very friable; slightly acid; clear smooth boundary.

C—28 to 60 inches; light yellowish brown (10YR 6/4) fine and medium sand; single grained; loose; few thin dark brown (7.5YR 4/4) loamy layers below a depth of 40 inches; slightly acid.

Thickness of the solum ranges from 24 to 40 inches. The Ap horizon is very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), or dark brown (10YR 3/3). The B2t and B3 horizons are dark brown (10YR 3/3), dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), or strong brown. Thin loamy bands up to 1 inch in thickness are in the C horizon below a depth of 40 inches.

Gotham soils are near Billett soils and formed in material similar to that in which Plainfield and Sparta soils formed. Gotham soils are coarser textured than Billett soils. They have thicker and finer textured A and B horizons than Plainfield soils and, unlike those soils, they have a Bt horizon. Gotham soils have a thinner and lighter colored A horizon than Sparta soils.

GoB—Gotham loamy sand, 1 to 6 percent slopes. This gently sloping soil is on stream terraces. Most areas are irregularly shaped and range from 10 to 70 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Billett and Plainfield soils.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. It is better to plant early in spring in this soil, before the soil has a chance to dry out. Management practices are needed to supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most areas of this soil are used for crops, but some areas are planted to pine trees. This soil is not well suited to most crops commonly grown in the county. Supplemental irrigation is necessary for dependable crop production. This soil has slight or moderate limitations for most nonfarm uses. Capability unit IVs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

GoC2—Gotham loamy sand, 6 to 12 percent slopes, eroded. This sloping soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 8 to 60 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer of this soil is slightly thinner and lighter colored than the one in the representative profile. Included in mapping are small areas of Plainfield soils.

Runoff is medium, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. It is better to plant early in spring in this soil, before the soil has a chance to dry out. Management practices are needed to supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Some areas of this soil are used for crops, but many areas are in grass or are planted to pine trees. This soil is not well suited to most crops commonly grown in the county. Supplemental irrigation is necessary for dependable crop production. This soil has slight or moderate limitations for most nonfarm uses. Capability unit IVs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

GsB—Gotham loamy sand, sandstone substratum, 2 to 6 percent slopes. This gently sloping soil is on stream terraces along the base of sandstone uplands. Most areas are irregularly shaped and range from 10 to 70 acres in size. This soil has a profile similar to the one described as representative for the series, but it is underlain by sandstone at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Gotham soils and areas where the depth to sandstone is slightly more than 60 inches.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. It is better to plant early in spring in this soil, before the soil has a chance to dry out. Management practices are needed to supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most areas of this soil are used for crops. This soil is not well suited to most crops commonly grown in the county. Supplemental irrigation is necessary for dependable crop production. This soil has moderate or severe limitations for many nonfarm uses. Capability unit IVs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

GsC2—Gotham loamy sand, sandstone substratum, 6 to 12 percent slopes, eroded. This sloping soil is on stream terraces at the base of sandstone uplands. Most areas are long and narrow and range from 8 to 50 acres in size. This soil has a profile similar to the one described as representative for the series, but it is underlain by sandstone at a depth of 40 to 60 inches and has a slightly thinner and lighter colored surface layer than the one in the representative profile. Included in mapping are small areas of Gotham and Plainbo soils.

Runoff is medium, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. It is better to plant early in spring in this soil, before the soil has a chance to dry out. Management practices are needed to supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most areas of this soil are used for crops. This soil is not well suited to most crops commonly grown in the county. Supplemental irrigation is necessary for dependable crop production. This soil has moderate or severe limitations for many nonfarm uses. Capability unit IVs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

Hiles Series

The Hiles series consists of well drained and moderately well drained, gently sloping and sloping, loamy soils on sandstone and shale ridges. Native vegetation is hardwood trees.

In a representative profile the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 8 inches thick. The subsoil is about 11 inches thick. The upper part is

dark brown silt loam, and the lower part is olive silty clay loam. The substratum to a depth of about 60 inches is mottled, light brownish gray and olive stratified sandstone residuum and silty clay.

Available water capacity is moderate. Permeability is moderate in the upper part of these soils and slow in the lower part. Natural fertility is medium. During wet periods these soils are saturated at a depth of 3 to 5 feet.

Most areas of these soils are used for crops or pasture. Some small areas remain in woods. Hiles soils are well suited or moderately well suited to farming if erosion is controlled. They are also suited to wildlife habitat and woodland. Limitations for many nonfarm uses are moderate or severe.

Representative profile of Hiles silt loam in a cultivated area of Hiles and Kert soils, 2 to 6 percent slopes, 30 feet south and 900 feet east of the northwest corner of the SW¼ sec. 13, T. 26 N., R. 5 E.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak very fine subangular blocky structure; friable; strongly acid; abrupt smooth boundary.

A2—8 to 16 inches; brown (10YR 5/3) silt loam; weak thin platy structure; friable; very strongly acid; clear wavy boundary.

B&A—16 to 22 inches; dark brown (10YR 4/3) silt loam (B2t); few fine faint dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; few thin clay films on ped faces; tongues of brown (10YR 5/3) silt loam (A2) penetrate this horizon; very strongly acid; clear wavy boundary.

IIB2t—22 to 27 inches; olive (5Y 5/3) silty clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous clay films and light gray (10YR 7/2) silt coatings on ped faces; few small sandstone fragments; very strongly acid; clear wavy boundary.

IIC—27 to 60 inches; light brownish gray (2.5Y 6/2) sandstone residuum stratified with thin layers of olive (5Y 5/3) silty clay shale residuum that has common medium distinct light brownish gray (2.5Y 6/2) mottles; very strongly acid.

Thickness of the solum ranges from 20 to 40 inches. The silt loam deposit over the sandstone and shale residuum ranges in thickness from about 15 to 30 inches. The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). The A2 horizon is brown (10YR 5/3) or grayish brown (10YR 5/2) and is 4 to 10 inches thick. The B&A horizon is 4 to 8 inches thick. The IIB2t horizon is light olive brown (2.5Y 5/4), olive brown (2.5Y 4/4), or olive (5Y 5/3) loam or silty clay loam and ranges from 4 to 10 inches in thickness. In places it has a few mottles. The IIC horizon varies in color and texture from place to place, reflecting the interlayering of residuum from sandstone and shale.

Hiles soils are near Humbird and Kert soils. They are finer textured in the upper part of the solum than Humbird soils. Hiles soils are well drained and moderately well drained, and Kert soils are somewhat poorly drained.

HeC2—Hiles silt loam, 6 to 12 percent slopes, eroded. This sloping soil is mainly on the crests and sides of low ridges. Most areas are irregularly shaped and range from 8 to 50 acres in size. Some areas are in long, narrow bands at the bases of valley slopes below higher lying soils. This soil has a profile similar to the one described as representative for the series, but the surface layer and subsoil are slightly thinner in places.

Included with this soil in mapping are small areas of Gale and Northfield soils. Small areas of wet soils are indicated by wet spot symbols on the soil map.

Runoff is medium to rapid, and the hazard of erosion is moderate. Management practices are needed to reduce runoff, control erosion, conserve moisture, and maintain organic matter content and tilth.

Most areas of this soil are used for crops, but a few small areas are in pasture or woods. This soil is moderately well suited to farming if erosion is controlled and tilth is maintained. It is also suited to pasture, woodland, and wildlife habitat. It has moderate or severe limitations for most nonfarm uses. Capability unit IIIe–6; woodland suitability group 2o1; wildlife group 1; recreation group 1.

HkB—Hiles and Kert soils, 2 to 6 percent slopes. These gently sloping soils are on the crests and sides of low ridges. Most areas are irregularly shaped and range from 6 to 35 acres in size.

This mapping unit is about 60 percent Hiles silt loam and 40 percent Kert loam. The Hiles soil in this unit has the profile described as representative for its series.

Runoff is slow to medium, and the erosion hazard is slight. Available water capacity is moderate, and natural fertility is medium. Permeability is moderate in the upper part and slow in the lower part of Hiles soils, and it is moderate to slow in Kert soils. Management practices are needed to reduce runoff, control erosion, conserve moisture, and maintain organic matter content and tilth on Kert soils.

Most areas of these soils are used for crops or pasture, but small areas are in woods. These soils are suited or well suited to all crops commonly grown in the county. They are also suited to pasture, woodland, and wildlife habitat. They have moderate or severe limitations for most nonfarm uses. Capability unit IIe–6; woodland suitability group 2o1; wildlife groups 1 and 6; recreation group 5.

Hixton Series

The Hixton series consists of well drained, gently sloping to moderately steep, loamy soils underlain by sandstone. These soils are on uplands throughout the county. Native vegetation is hardwood trees.

In a representative profile the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is brown light loam about 3 inches thick. The subsoil is about 16 inches thick. It is dark brown loam in the upper part and dark brown sandy loam in the lower part. The substratum to a depth of about 36 inches is yellowish brown sand. It is underlain by weakly cemented sandstone over hard sandstone to a depth of about 60 inches.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderate.

Most areas of these soils are used for crops, but areas of steeper soils are in grass or trees. These soils range from suited to not well suited to all crops commonly grown in the county. Limitations for most nonfarm uses are moderate.

Representative profile of Hixton loam, 6 to 12 percent slopes, eroded (in an area where this soil is uneroded), in a cultivated field, 150 feet south and 400 feet west of the northeast corner of the NW¼ sec. 6, T. 27 N., R. 8 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; moderate fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A2—8 to 11 inches; brown (10YR 5/3) light loam; weak medium platy structure; friable; slightly acid; clear smooth boundary.

B1—11 to 15 inches; dark brown (7.5YR 4/4) light loam; weak medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

B2t—15 to 23 inches; dark brown (7.5YR 4/4) heavy loam; moderate medium subangular blocky structure; firm; thick patchy clay films; strongly acid; clear smooth boundary.

B3—23 to 27 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; strongly acid; gradual smooth boundary.

IIC1—27 to 36 inches; yellowish brown (10YR 5/4) sand; single grained; loose; many sandstone fragments; strongly acid; clear smooth boundary.

IIC2—36 to 48 inches; brownish yellow (10YR 6/6) weakly cemented sandstone; strongly acid; abrupt smooth boundary.

R—48 to 60 inches; brownish yellow (10YR 6/6) hard sandstone that has layers of soft and weakly cemented sandstone.

Thickness of the solum ranges from 20 to 40 inches. Depth to underlying sandstone ranges from about 30 to 40 inches. The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2).

Hixton soils are near Eleva, Elkmound, Gale, and Northfield soils. Hixton soils have a higher clay content in the B2t horizon than Eleva soils. They have thicker A and B horizons than Elkmound and Northfield soils. Hixton soils are not as fine textured as Gale soils.

HnB—Hixton loam, 2 to 6 percent slopes. This gently sloping soil is on ridgetops on sandstone uplands. Most areas are long and narrow or irregularly shaped and range from 5 to 40 acres in size. This soil has a profile similar to the one described as representative for the series, but it is deeper to sand and has a surface layer that is slightly darker. Included in mapping are small areas of Gale and Northfield soils.

Runoff is medium, and the erosion hazard is slight. Management practices are needed to maintain organic matter content, conserve moisture, reduce runoff, and control erosion.

Most areas of this soil are used for crops. This soil is well suited to all crops commonly grown in the county. It has moderate limitations for most nonfarm uses. Capability unit IIe–2; woodland suitability group 2o1; wildlife group 1; recreation group 1.

HnC2—Hixton loam, 6 to 12 percent slopes, eroded. This sloping soil is on the sides and tops of hills and ridges on sandstone uplands. Most areas are irregularly shaped and range from 6 to 65 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Eleva and Northfield soils. Also included are small areas of severely eroded Hixton soils.

Runoff is medium, and the erosion hazard is moderate. Management practices are needed to maintain organic matter content, conserve moisture, reduce runoff, and control erosion.

Most areas of this soil are used for crops. This soil is moderately well suited to all crops commonly grown in the county. It has moderate limitations for most nonfarm uses. Capability unit IIIe–2; woodland suitability group 2o1; wildlife group 1; recreation group 1.

HnD2—Hixton loam, 12 to 20 percent slopes, eroded. This moderately steep soil is on hills and ridges on sandstone uplands. Most areas are long and narrow and range from 5 to 40 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer is slightly thinner in this soil than it is in the representative profile. In places the surface layer is brown rather than dark brown where the subsurface layer and subsoil have been mixed by plowing.

Included with this soil in mapping are small areas of Eleva, Elkmound, and Northfield soils. Also included are small areas of severely eroded Hixton soils and a few areas of steeper soils.

Runoff is rapid, and the erosion hazard is severe. Management practices are needed to maintain organic matter content, conserve moisture, reduce runoff, and control erosion.

Most areas of this soil are used for crops, but a fairly large part of the acreage is in grass or trees. This soil is not well suited to cultivated crops. It has severe limitations for most nonfarm uses. Capability unit IVe–2; woodland suitability group 2r1; wildlife group 1; recreation group 1.

Houghton Series

The Houghton series consists of very poorly drained, nearly level, organic soils in depressions in large stream basins. These soils are more than 51 inches thick. Native vegetation is grasses, sedges, and reeds.

In a representative profile the organic layer is black muck about 42 inches thick. This layer is underlain to a depth of about 60 inches or more by very dark gray muck.

Available water capacity is very high in these soils, and natural fertility is low. Permeability is rapid. Ground water is typically one foot or less below the surface. This soil is subject to ponding.

Some areas of these soils have been drained and are used for crops or pasture. Most areas are undrained and are either wooded or are wetland wildlife habitat. These soils are poorly suited to woodland. Limitations for most nonfarm uses are severe.

Representative profile of Houghton muck that has 0 to 2 percent slopes, 1,100 feet west and 50 feet south of the northeast corner of sec. 7, T. 25 N., R. 9 W.:

Oa1—0 to 10 inches; black (N 2/0 broken face and rubbed) sapric material; weak medium crumb structure; medium acid; clear smooth boundary.

Oa2—10 to 24 inches; black (N 2/0 broken face), black (10YR 2/1 rubbed) sapric material; about 15 percent fibers, less than 5 percent fibers rubbed; weak thick platy structure in places, parting to weak medium crumb; slightly acid; clear smooth boundary.

Oa3—24 to 36 inches; black (10YR 2/1 broken face), very dark gray (10YR 3/1 rubbed) sapric material; about 35 percent fibers, less than 10 percent fibers rubbed; weak thick platy structure; slightly acid; clear smooth boundary.

Oa4—36 to 42 inches; black (10YR 2/1 broken face), very dark grayish brown (10YR 3/2 rubbed) sapric material; about 35 percent fibers, less than 10 percent fibers rubbed; thick platy structure; slightly acid; clear smooth boundary.

Oa5—42 to 60 inches; very dark gray (10YR 3/1 broken face) very dark grayish brown (10YR 3/2 rubbed) sapric material; about 15 percent fibers, less than 5 percent fibers rubbed; thick platy structure; slightly acid.

This soil is more than 60 inches thick over mineral soil in most places. The surface layer is muck or peat, but in most places it is muck. The organic soil beneath the surface layer ranges in fiber content from 10 to 35 percent unrubbed. Small amounts of woody fragments are in some areas.

Houghton soils are near Adrian and Markey soils. Houghton soils are deeper to underlying mineral soil than those soils.

Ho—Houghton muck (0 to 2 percent slopes). This nearly level soil is in depressions in stream valleys. Most areas are irregularly shaped. They range from 20 to 200 acres in size.

Included with this soil in mapping are small areas of Adrian soils. Also included are small areas of an organic soil that has deposits of mineral soil washed from surrounding uplands.

The water table is at or near the surface of this soil during most of the year. In many areas water ponds in spring or in other seasons of the year following heavy rainfall. Burning, soil blowing, and subsiding are serious concerns in drained areas. This soil is in low basins, and crops grown on it are subject to greater frost damage than crops grown on nearby, higher lying soils.

Only a small part of the total acreage of this soil is drained and used for crops and pasture. Most areas are used for wetland wildlife habitat. If adequately drained, this soil is suited to crops commonly grown in the county. It is also suited to such specialized crops as sod, truck crops, and canning crops. This soil has severe limitations for most nonfarm uses. Capability unit IVw–9; woodland suitability group 3w3; wildlife group 8; recreation group 8.

Humbird Series

The Humbird series consists of well drained and moderately well drained, gently sloping and sloping soils on sandstone uplands. Native vegetation is mixed hardwood and pine forest, mainly northern red oak, jack pine, and white pine.

In a representative profile the surface layer is black sandy loam about 1 inch thick. The subsurface layer is pinkish gray sandy loam about 8 inches thick. The subsoil and associated subsurface layers are about 29 inches thick. The upper part is dark brown and dark yellowish brown sandy loam, the middle part is pale brown and brown sandy loam, and the lower part is reddish brown sandy loam and olive gray silty clay. The lower part of the subsoil is mottled. The substratum to a depth of about 60 inches is yellowish brown sandstone that has layers of olive gray shale.

Available water capacity and natural fertility are low in these soils. Permeability is moderate in the upper part of the soil and moderately slow in the lower part. In places areas of these soils are saturated at a depth of 3 to 5 feet during wet periods.

Most areas of these soils are in woods. Some areas have been cleared and are used for crops or pasture. These soils are suited to farming if erosion is controlled. They are also suited to pasture, woodland, and wildlife habitat. Limitations for nonfarm uses range from slight to severe.

In this county Humbird soils are mapped only in association with Ludington soils.

Representative profile of Humbird sandy loam in an uncultivated area of Ludington and Humbird soils, 2 to 6 percent slopes, 600 feet south and 500 feet east of the northwest corner of the SW¼ sec. 15, T. 27 N., R. 6 W.:

A1—0 to 1 inch; black (10YR 2/1) sandy loam; moderate fine granular structure; friable; extremely acid; abrupt smooth boundary.

A2—1 inch to 9 inches; pinkish gray (7.5YR 6/2) sandy loam; weak thin platy structure; friable; very strongly acid; abrupt wavy boundary.

B21ir—9 to 12 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; strongly acid; clear wavy boundary.

B22ir—12 to 16 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; strongly acid; clear wavy boundary.

A'21—16 to 20 inches; pale brown (10YR 6/3) sandy loam; weak medium platy structure; friable; strongly acid; clear smooth boundary.

A'22—20 to 24 inches; brown (10YR 5/3) sandy loam; few medium faint dark yellowish brown (10YR 4/4) mottles; weak medium platy structure parting to weak very fine subangular blocky; friable; very strongly acid; clear wavy boundary.

B'2t—24 to 31 inches; reddish brown (5YR 4/4) sandy loam; few medium faint dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; few thin light gray (10YR 7/1) very fine sand coatings and few thin discontinuous clay films on ped faces; very strongly acid; abrupt smooth boundary.

IIB'3t—31 to 38 inches; olive gray (5Y 5/2) silty clay; few medium distinct dark brown (7.5YR 4/4) and prominent strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; firm; thin discontinuous clay films on some ped faces; very strongly acid; clear smooth boundary.

IIIC—38 to 60 inches; yellowish brown (10YR 5/4) and very pale brown (10YR 7/4) sandstone residuum that has thin layers of olive gray (5Y 5/2) shale; extremely acid.

Thickness of the solum is typically 20 to 40 inches, but it ranges from 20 to 50 inches. In cultivated areas the Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2) and is 6 to 8 inches thick. The A2 horizon is pinkish gray (7.5YR 6/2) or brown (10YR 5/3) sandy loam or loamy fine sand and is 2 to 10 inches thick. In cultivated areas the A2 horizon is either thin or it is not present. The B21ir and B22ir horizons are dark brown (7.5YR 4/4) or dark yellowish brown (10YR 4/4) sandy loam or loamy fine sand. The A'21 and A'22 horizons are sandy loam or loamy fine sand. In places they are not present. The B'2t and IIB'3t horizons are sandy loam, sandy clay loam, silty clay loam, or silty clay. The color of these horizons varies considerably. Texture in the IIIC horizon varies from place to place, reflecting the interlayering of residuum weathered from sandstone and shale.

Humbird soils are near Hiles, Ludington, and Merrillan soils. Humbird soils are coarser textured than Hiles soils. They are finer textured in the upper part of the solum than Ludington soils. Humbird soils are better drained than Merrillan soils.

Kert Series

The Kert series consists of somewhat poorly drained, nearly level and gently sloping, loamy soils on the tops and sides of low sandstone ridges and knolls. The underlying sandstone is intermixed with shale. Native vegetation is hardwood trees.

In a representative profile the surface layer is very dark grayish brown loam about 6 inches thick. The subsurface layer is brown, mottled loam about 9 inches thick. The subsoil is about 21 inches thick. It is brown, mottled loam in the upper part and grayish brown, mottled sandy loam in the lower part. The substratum to a depth of about 60 inches is light olive brown soft sandstone that has layers of loamy and clayey shale.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderate to moderately slow. In undrained areas these soils are saturated at a depth of 1 to 3 feet during wet periods.

More than half of the acreage of Kert soils is used for crops. The rest is used for woodland, pasture, or wildlife habitat. These soils are suited to farming if excess water is removed and erosion is controlled. They are also suited to pasture, woodland, and wildlife habitat. Limitations for many nonfarm uses are moderate or severe.

Representative profile of Kert loam, 0 to 3 percent slopes, in a cultivated area, 800 feet north and 300 feet east of the southwest corner of sec. 5, T. 27 N., R. 10 W.:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) when dry; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A2—6 to 11 inches; brown (10YR 5/3) loam; few fine faint dark brown (7.5YR 4/4) mottles; weak thin platy structure; friable; very strongly acid; clear wavy boundary.

A&B—11 to 15 inches; brown (10YR 5/3) loam (A2); common medium faint dark brown (7.5YR 4/4) and grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; brown (10YR 5/3) heavy loam extensions of the B2t horizon make up about 30 percent of the soil; few thin discontinuous clay films on ped faces in the B2t part of the horizon; very strongly acid; clear smooth boundary.

B2t—15 to 28 inches; brown (10YR 5/3) heavy loam; many medium faint dark brown (7.5YR 4/4) and grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; thin discontinuous clay films and light gray (10YR 7/2) silt coatings on ped faces; very strongly acid; clear smooth boundary.

IIB3—28 to 36 inches; grayish brown (10YR 5/2) sandy loam; many medium distinct dark brown (7.5YR 4/4) and prominent strong brown (7.5YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; very strongly acid; gradual smooth boundary.

IIC—36 to 60 inches; light olive brown (2.5Y 5/4) soft sandstone containing layers of loamy and clayey shale; very strongly acid.

Thickness of the solum typically is 24 to 40 inches, but it ranges to as much as 50 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). In uncultivated areas the A1 horizon is black (10YR 2/1) or very dark gray (10YR 3/1). The Ap or A1 horizon is loam or silt loam that contains a considerable amount of fine sand. The A2 horizon is brown (10YR 5/3) or grayish brown (10YR 5/2) and has mottles of dark brown (7.5YR 4/4), strong brown (7.5YR 5/6), and grayish brown (10YR 5/2). It is loam, sandy loam, or loamy sand. The A&B horizons have the range of characteristics of the A2 and B2t horizons.

The B2t horizon is brown (10YR 5/3), yellowish brown (10YR 5/4), or light olive brown (2.5Y 5/4). It is loam, silt loam, or silty clay loam. The IIB3 horizon, if present, is sandy loam or loamy sand. The IIC horizon has a wide range of colors and textures, reflecting the variations in the interlayering of the sandstone and shale. It is typically soft sandstone that has thin strata of hard platy sandstone and layers of loamy or clayey shale.

Kert soils are near Hiles and Vesper soils. Kert soils have more mottles and poorer internal drainage than Hiles soils. They are not so poorly drained as Vesper soils.

KeA—Kert loam, 0 to 3 percent slopes. This nearly level and gently sloping soil is on sandstone uplands. Most areas are irregularly shaped and range from 4 to 60 acres in size.

Included with this soil in mapping are small areas of Hiles, Merrillan, and Vesper soils.

Runoff is slow, and the erosion hazard is slight or moderate. Management practices are needed to remove excess water and control erosion.

If this soil is adequately drained and erosion is controlled, the soil is suited to crops commonly grown in the county. It is also suited to pasture and woodland. It has moderate or severe limitations for nonfarm uses. Capability unit IIw–3; woodland suitability group 2o2; wildlife group 6; recreation group 5.

Lows Series

The Lows series consists of poorly drained, nearly level, loamy soils underlain by sand. These soils are on stream terraces and in old glacial lake basins. Native vegetation is grasses and trees that require large amounts of water.

In a representative profile the surface layer is very dark gray loam about 8 inches thick. The subsurface layer is grayish brown, mottled loam about 6 inches thick. The subsoil is about 14 inches thick. It is light brownish gray, mottled loam in the upper part and gray, mottled loam in the lower part. The substratum to a depth of about 60 inches is gray sand.

Available water capacity is moderate, and natural fertility is medium. Permeability is moderate. In undrained areas ground water is at or near the surface throughout the year.

Most areas of these soils are used for crops. Some areas are used for woodland, pasture, or wildlife habitat. Lows soils are suited to farming if adequately drained. They are also suited to pasture and to trees that are suited to wet soils. Limitations for most nonfarm uses are severe.

Representative profile of Lows loam that has 0 to 2 percent slopes, in a cultivated field, 800 feet north and 300 feet east of the southwest corner of sec. 5, T. 27 N., R. 10 W.:

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) when dry; weak medium subangular blocky structure; friable; strongly acid; abrupt smooth boundary.

A2g—8 to 14 inches; grayish brown (10YR 5/2) loam; many medium distinct dark yellowish brown

(10YR 4/4) and brown (10YR 5/3) mottles; weak thin platy structure; friable; strongly acid; clear smooth boundary.

B1g—14 to 19 inches; light brownish gray (10YR 6/2) loam; many medium distinct dark yellowish brown (10YR 4/4) and brown (10YR 5/3) mottles; weak fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

B2g—19 to 25 inches; light brownish gray (10YR 6/2) loam; many medium distinct dark yellowish brown (10YR 4/4) and brown (10YR 5/3) mottles; weak medium subangular blocky structure; firm; strongly acid; clear smooth boundary.

B3g—25 to 28 inches; gray (10YR 6/1) loam; many medium prominent dark yellowish brown (10YR 4/4) and brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; strongly acid; clear smooth boundary.

IICg—28 to 60 inches; gray (10YR 6/1) sand; single grained; loose; strongly acid.

Thickness of the solum ranges from 20 to 40 inches and is nearly the same as depth to sand. The Ap or A1 horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or black (10YR 2/1) and ranges from 6 to 10 inches in thickness. Texture is sandy loam or silt loam that has a high content of fine sand. In places the C horizon has thin loamy layers.

Lows soils are near Ettrick, Marshan, and Shiffer soils. Lows soils lack the thick black A horizon of Ettrick and Marshan soils. They have a darker colored A horizon and are more highly gleyed in the B horizon than Shiffer soils.

La—Lows loam (0 to 2 percent slopes). This nearly level soil is on flats and in slight depressions on stream terraces. Most areas are irregularly shaped and range from 10 to 100 acres in size.

Included with this soil in mapping are small areas of Marshan and Shiffer soils.

This soil has a high seasonal water table, and water ponds in spring or during heavy rainfall. Runoff is slow, and the erosion hazard is slight. Management practices are needed to remove excess water.

Most areas of this soil are used for crops, but in places areas are used for woodland, pasture, or wildlife habitat. If adequately drained, this soil is suited to all crops commonly grown in the county. It is also suited to pasture, woodland, and wetland wildlife habitat. This soil has severe limitations for most nonfarm uses. Capability unit IIw–5; woodland suitability group 3w2; wildlife group 7; recreation group 6.

Ludington Series

The Ludington series consists of well drained and moderately well drained, gently sloping and sloping soils on sandstone and shale uplands. Native vegetation is mixed deciduous and coniferous forests, mainly of red oak, white pine, and jack pine.

In a representative profile the surface layer is black loamy sand about 1 inch thick. The subsurface layer is pinkish gray loamy sand about 9 inches thick. The upper part of the subsoil is dark brown loamy sand about 8 inches thick. Below this is about 6 inches of yellowish brown medium and fine sand. The lower part of the subsoil is olive loam about 9 inches thick. The substratum to a depth of about 60 inches is layers of very pale brown hard sandstone and olive loamy shale and sandstone residuum.

Available water capacity and natural fertility are low in these soils. Permeability is rapid in the upper part of the soil and moderately slow in the lower part of the subsoil and in the substratum. In places areas of these soils are saturated at a depth of 3 to 5 feet during wet periods.

Most areas of Ludington soils are in woods, but a few areas are used for crops or pasture. These soils are suited to farming if erosion is controlled. They are also suited to pasture, woodland, or wildlife habitat. Limitation for most nonfarm uses are moderate or severe.

In this county Ludington soils are mapped only in association with Humbird soils.

Representative profile of Ludington loamy sand in an uncultivated area of Ludington and Humbird soils, 2 to 6 percent slopes, 1,100 feet south and 50 feet west of the NE¼ sec. 27, T. 27 N., R. 6 W.:

A1—0 to 1 inch; black (10YR 2/1) loamy sand; weak fine granular structure; very friable; many roots; many white (10YR 8/2) sand grains; very strongly acid; abrupt wavy boundary.

A2—1 inch to 10 inches; pinkish gray (7.5YR 6/2) loamy sand; single grained; loose; many roots; very strongly acid; abrupt wavy boundary.

B2ir—10 to 18 inches; dark brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; few roots; extremely acid; clear wavy boundary.

A'2—18 to 26 inches; yellowish brown (10YR 5/6) medium and fine sand; single grained; loose; few roots; strongly acid; clear wavy boundary.

IIB'2t—26 to 35 inches; olive (5Y 5/3) loam; moderate medium subangular blocky structure; firm; few thin discontinuous light olive brown (2.5Y 5/4) clay films on ped faces; few roots; extremely acid; clear smooth boundary.

IIIC—35 to 60 inches; stratified layers of very pale brown (10YR 7/3) hard sandstone about ½ inch thick; olive (5Y 4/4) loamy shale and sandstone residuum; shale has weak thin platy structure and is firm; extremely acid.

Thickness of the solum is typically 24 to 40 inches, but it ranges to 50 inches. Depth to residuum weathered from sandstone and shale is 20 to 40 inches. Part of the solum above a depth of 40 inches formed in layers of loamy and clayey residuum. Thickness and arrangement of the sandy, loamy, and clayey layers are extremely variable from place to place.

Ludington soils are near Fairchild and Humbird soils. Ludington soils are less mottled and have better internal drainage than Fairchild soils. They have less clay in the upper part of the solum than Humbird soils.

LuB—Ludington and Humbird soils, 2 to 6 percent slopes. These gently sloping soils are on knolls and on the crests and sides of sandstone and shale ridges. Most areas are irregularly shaped and range from 20 to 120 acres in size.

In places this mapping unit consists of Ludington loamy sand and Humbird sandy loam, and in other places it consists of one soil or the other. These soils have the profiles described as representative for their respective series. Included in mapping are small areas of Fairchild and Merrillan soils.

Runoff is slow, and the erosion hazard is slight. In the Ludington soil permeability is rapid in the upper part and moderately slow in the lower part of the subsoil and in the substratum. In the Humbird soils permeability is moderate in the upper part and moderately slow in the lower part. If they have not been previously limed, these soils need lime. Management

practices are needed to reduce runoff, control erosion, conserve moisture, and maintain organic matter content and fertility.

Most areas of these soils are in woods, but a few small areas are used for crops. These soils are moderately well suited to crops commonly grown in the county. Fertility and organic matter content must be maintained for optimum growth. These soils have severe limitations for urban uses, but slight or moderate limitations for most recreational uses. Capability unit IIIe–3; woodland suitability group 3s1; wildlife group 1; recreation group 2.

LuC—Ludington and Humbird soils, 6 to 12 percent slopes. These sloping soils are on sides of ridges that are underlain by sandstone and shale. Most areas are irregularly shaped and range from 20 to 100 acres in size.

In places this mapping unit consists of Ludington loamy sand and Humbird sandy loam, and in other places it consists of one soil or the other. These soils are similar to those described as representative for their respective series, but they are somewhat thinner. Included in mapping are small areas of Fairchild and Merrillan soils.

Runoff is medium, and the erosion hazard is moderate. In the Ludington soil permeability is rapid in the upper part and moderately slow in the lower part of the subsoil and in the substratum. In the Humbird soil permeability is moderate in the upper part and moderately slow in the lower part. If they have not been previously limed, these soils need lime. Management practices are needed to reduce runoff, control erosion, conserve moisture, and maintain organic matter content and fertility.

Most areas of these soils are in woods, but a few small areas are used for crops. These soils are not well suited to cultivated crops commonly grown in the county. Fertility and organic matter content must be maintained for good yields. These soils are suited to pasture, woodland, and wildlife habitat. They have severe limitations for urban uses, but slight or moderate limitations for recreational uses. Capability unit IVe–3; woodland suitability group 3s1; wildlife group 1; recreation group 2.

Markey Series

The Markey series consists of very poorly drained, nearly level, organic soils in depressions on outwash and till plains. Native vegetation is sedges and grasses.

In a representative profile the surface layer is black muck about 30 inches thick. The substratum to a depth of about 60 inches is gray sand.

Available water capacity is high in these soils, and natural fertility is low. Permeability is rapid. In undrained areas ground water is at or near the surface throughout the year.

Nearly all areas of these soils are undrained and remain in wetland vegetation. These soils are not well suited to farming unless drained and fertilized. Crops grown on these soils are subject to frost damage. Markey soils are poorly suited to woodland, but they are suited to some kinds of wildlife habitat. Limitations for most nonfarm uses are severe.

Representative profile of Markey muck that has 0 to 2 percent slopes, in an uncultivated area, 200 feet south and 200 feet east of the northwest corner of the NE¼ sec. 25, T. 27 N., R. 8 W.:

Oa1—0 to 16 inches; black (10YR 2/1) broken face and rubbed sapric material; about 10 percent fibers, less than 5 percent fibers rubbed; weak medium granular structure; very friable; medium acid; gradual smooth boundary.

Oa2—16 to 30 inches; black (10YR 2/1) broken face and rubbed sapric material; about 20 percent fibers, less than 5 percent fibers rubbed; weak coarse subangular blocky structure; friable; medium acid; clear smooth boundary.

IIC—30 to 60 inches; gray (10YR 6/1) sand; single grained; loose; medium acid.

Thickness of the sapric layer ranges from 16 to 51 inches. Some profiles are as much as 15 percent, by volume, fragments of twigs, branches, or small logs.

Markey soils formed in material similar to that in which Adrian and Houghton soils formed. The temperature of Markey soils is lower than that of Adrian and Houghton soils. Markey soils are less than 51 inches thick over sand, and Houghton soils are more than 51 inches thick over mineral soil.

Ma—Markey muck (0 to 2 percent slopes). This nearly level soil is in depressions on old glacial lake basins or stream terraces. Most areas are irregularly shaped and range from 30 to 120 acres in size. Included in mapping are small areas of Houghton and Newson soils.

Runoff is very slow, and this soil is ponded part of the year. Burning, soil blowing, and subsidence are serious concerns in drained areas. Because this soil is in a low position on the landscape, crops grown in it are subject to frost damage. Management practices are needed to remove excess water and increase fertility.

Nearly all areas of this soil are undrained and used for wetland wildlife habitat. This soil is better suited to wetland wildlife habitat than to crops. If adequately drained, however, it is moderately well suited to forage crops. It is also suited to water demanding crops such as cranberries. This soil has severe limitations for most nonfarm uses. Capability unit IVw–7; woodland suitability group 3w3; wildlife group 8; recreation group 8.

Marshan Series

The Marshan series consists of poorly drained and very poorly drained, nearly level loamy soils underlain by sand. These soils are in slight depressions on stream terraces and outwash plains. Native vegetation is made up of such plants as reeds and sedges that require large amounts of water.

In a representative profile the surface layer is black loam about 16 inches thick. The subsoil is about 22 inches thick. It is dark gray loam in the upper part, gray loam and silt loam in the middle part, and gray sandy loam in the lower part. The lower part of the surface layer and the subsoil are mottled. The substratum to a depth of about 60 inches is gray fine sand that has thin layers of loamy material.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is mainly moderate, but it is rapid in the underlying sand. In undrained areas ground water is at or near the surface throughout the year.

Most areas of these soils are cultivated, and some areas are in permanent pasture. These soils are suited to farming if they are adequately drained. They are also suited to some types of wildlife habitat. Marshan soils are poorly suited to woodland. Limitations for most nonfarm uses are severe.

Representative profile of Marshan loam that has 0 to 2 percent slopes, in a cultivated field, 50 feet west and 100 feet north of the southeast corner of the NE¼ sec. 7, T. 27 N., R. 10 W.:

Ap—0 to 10 inches; black (10YR 2/1) loam; weak medium granular structure; friable; medium acid; abrupt smooth boundary.

A12—10 to 16 inches; black (10YR 2/1) loam; few medium prominent dark brown (7.5YR 4/4) mottles; weak medium platy structure; friable; medium acid; gradual smooth boundary.

B1—16 to 22 inches; dark gray (10YR 4/1) loam; many medium prominent dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; medium acid; clear smooth boundary.

B21g—22 to 26 inches; gray (10YR 5/1) loam; many medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; firm; few dark gray (10YR 4/1) organic flows in root channels; medium acid; clear smooth boundary.

B22g—26 to 34 inches; gray (5Y 6/1) silt loam that is high in fine sand content; many medium prominent dark reddish brown (5YR 3/4), reddish brown (5YR 4/4), and dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm; medium acid; clear smooth boundary.

IIB3g—34 to 38 inches; gray (5Y 5/1) sandy loam; many medium prominent dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

IICg—38 to 60 inches; gray (5Y 5/1) fine sand with thin laminae of loamy material; single grained; loose; medium acid.

Thickness of the solum ranges from 20 to 40 inches. It is nearly the same as the depth to sand. Thickness of the A horizon ranges from 10 to 20 inches. Texture of the B horizon is loam or is silt loam that has moderate sand content.

Marshan soils are near Lows soils. They have a thicker and blacker A horizon than those soils.

Mc—Marshan loam (0 to 2 percent slopes). This nearly level soil is in slight depressions on broad stream terraces and outwash plains. Most areas are irregularly shaped and range from 6 to 30 acres in size. Included in mapping are a few small areas of Lows soils.

Runoff is slow or very slow, and this soil is ponded in spring and after periods of extended rainfall. The erosion hazard is slight. Because of wetness, this soil generally must be tilled about two weeks later in spring than nearby, well drained soils. Surface drainage removes excess water rapidly. Both deep ditches and tile drains are used for internal drainage. If tile drains are used, care must be taken to prevent loose sand from entering the tile lines. Crops grown on this soil are subject to frost damage. Management practices are needed to remove excess water and maintain organic matter content and tilth.

About half of the acreage of this soil is used for crops. The rest is in grasses and is used for pasture or wildlife habitat. If adequately drained, this soil is suited to crops commonly grown in the county. This soil is not well suited to trees. It is suited to wetland wildlife habitat. It has severe limitations for nonfarm uses. Capability unit IIw–5; woodland suitability group 4w2; wildlife group 7; recreation group 6.

Menahga Series

The Menahga series consists of excessively drained, nearly level to sloping sandy soils on stream terraces and outwash plains. Native vegetation is mainly white pine, jack pine, and scrub oak.

In a representative profile the surface layer is very dark grayish brown sand about 2 inches thick. The subsurface layer is dark grayish brown sand about 3 inches thick. The subsoil is dark yellowish brown and yellowish brown sand about 19 inches thick. The substratum to a depth of about 60 inches is pale brown and very pale brown sand.

Permeability is rapid in these soils. Available water capacity is very low, and natural fertility is low.

Most areas of these soils are in native pine or oak trees. Also, pine trees have been planted in many areas that were once used for crops. These soils are too sandy and too droughty for farming. Irrigation is probably not feasible. Limitations for many nonfarm uses are slight to severe.

Representative profile of Menagha sand, 1 to 6 percent slopes, in a wooded area, 150 feet north and 900 feet west of the southeast corner of the SW¼ sec. 8, T. 26 N., R. 6 W.:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) medium sand; weak fine granular structure; very friable; very strongly acid; abrupt wavy boundary.

A2—2 to 5 inches; dark grayish brown (10YR 4/2) medium sand; single grained; loose; very strongly acid; clear smooth boundary.

B2—5 to 18 inches; dark yellowish brown (10YR 4/4) medium sand; single grained; loose; strongly acid; gradual smooth boundary.

B3—18 to 24 inches; yellowish brown (10YR 5/4) medium sand; single grained; loose; medium acid; gradual smooth boundary.

C1—24 to 36 inches; pale brown (10YR 6/3) medium sand; single grained; loose; slightly acid; gradual smooth boundary.

C2—36 to 60 inches; very pale brown (10YR 7/4) medium sand; single grained; loose; slightly acid.

Thickness of the solum ranges from about 18 to 34 inches. The solum formed mainly in medium sand. The A1 horizon is very dark gray (10YR 3/1), black (10YR 2/1), or very dark grayish brown (10YR 3/2). It is medium sand or loamy sand. In cultivated areas the Ap horizon is dark grayish brown (10YR 4/2). The A2 horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). In places the A2 horizon is lacking. The B horizon is dark brown (10YR 4/3), brown (10YR 5/3), yellowish brown (10YR 5/4), or dark yellowish brown (10YR 4/4). The C horizon is typically medium sand, but in places is coarse sand.

Menahga soils formed in the same kind of material as Friendship, Plainfield, and Vilas soils. Menahga soils are excessively drained, and Friendship soils are moderately well drained. Menahga soils generally have a lower year around temperature than Plainfield soils. They lack the accumulation of humus and iron in the B horizon of Vilas soils.

MdB—Menahga sand, 1 to 6 percent slopes. This gently sloping soil is on stream benches and outwash plains. Most areas are irregularly shaped and range from 25 to 300 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Friendship, Plainfield, and Vilas soils. Small areas of Menagha soils that have been severely eroded by soil blowing are indicated by blowout spot symbols on the soil map.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Management practices are needed to maintain plant cover and prevent erosion and soil blowing.

Most areas of this soil remain in native stands of scrub oak and jack pine or have been replanted to evergreens. Some areas are used for homesites (fig. 6). In cultivated areas this soil needs protection from erosion, some form of irrigation, and increased fertility to provide suitable crops. If not irrigated this soil is unsuited to crops and pasture. It is better suited to vegetation that does not demand much water, such as red pine or jack pine. This soil has slight or moderate limitations for most nonfarm uses. Capability unit VIIs–9; woodland suitability group 3s1; wildlife group 3; recreation group 4.

MdC—Menagha sand, 6 to 12 percent slopes. This sloping soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 20 to 200 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer is thinner.

Included with this soil in mapping are small areas of Boone-Plainbo complex and Plainfield soils. Small areas of Menagha soils that have been severely eroded by soil blowing are indicated by blowout spot symbols on the soil map.

Runoff is medium, and the erosion hazard is moderate. This soil is subject to soil blowing. Management practices are needed to maintain plant cover and prevent erosion and soil blowing.

Most areas of this soil remain in woods. Areas that previously were cleared have been replanted to pine trees. This soil is not suited to farming. It is better suited to vegetation that does not demand much water, such as red pine and jack pine. It has moderate or severe limitations for most nonfarm uses. Capability unit VIIs–9; woodland suitability group 3s1; wildlife group 3; recreation group 4.

Figure 6.—**Housing development in young pine plantation on Menahga sand near the city of Eau Claire.**

Meridian Series

The Meridian series consists of well drained, nearly level to sloping, loamy soils underlain by sand. These soils are on stream terraces and outwash plains. Native vegetation is hardwood trees.

In a representative profile the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown loam 3 inches thick. The subsoil is brown and dark brown loam about 19 inches thick. The substratum to a depth of about 60 inches is light yellowish brown sand.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderate.

Nearly all areas of these soils are used for farming. A few areas are in woods or pasture. These soils are suited to farming if erosion is controlled and good tilth is maintained. They are also suited to open land wildlife habitat and woodland. Limitations for nonfarm uses are slight or moderate.

Representative profile of Meridian loam, 0 to 2 percent slopes, in a cultivated field, 1,200 feet west and 50 feet south of the northeast corner of sec. 5, T. 27 N., R. 10 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) when dry; weak medium subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A2—8 to 11 inches; dark grayish brown (10YR 4/2) loam; weak medium platy structure; friable; slightly acid; clear smooth boundary.

B21t—11 to 18 inches; brown (10YR 5/3) loam; moderate fine subangular blocky structure; firm; thin patchy clay films; medium acid; higher clay content than the A2 horizon; clear smooth boundary.

B22t—18 to 26 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; thick patchy clay films; higher clay content than the A2 and B3 horizons; strongly acid; clear smooth boundary.

B3—26 to 30 inches; dark brown (7.5YR 4/4) light loam; weak medium subangular blocky structure; strongly acid; gradual smooth boundary.

IIC—30 to 60 inches; light yellowish brown (10YR 6/4) sand; single grained; loose; strongly acid.

Thickness of the solum ranges from 20 to 40 inches and is nearly the same as depth to sand. In some cultivated areas, the A2 horizon has been mixed into the Ap horizon by plowing. In places mottles are in the lower part of the B2 horizon and in the B3 horizon, and thin loamy strata are in the C horizon.

Merdian soils are near Billett and Tell soils. Meridian soils have a finer texture and a higher clay content in the B horizon than Billett soils. They have a coarser texture than Tell soils.

MeA—Meridian loam, 0 to 2 percent slopes. This nearly level soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 20 to 100 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Meridian soils that are moderately well drained and small areas of Tell soils.

Runoff is slow, and the erosion hazard is slight. Management practices are needed to conserve moisture, maintain organic matter content, reduce runoff, and control erosion.

Nearly all areas of this soil are used for crops. This soil is suited to all crops commonly grown in the county. It is also suited to trees and wildlife habitat. It has slight or moderate limitations for nonfarm uses. Capability unit IIs–1; woodland suitability group 2o1; wildlife group 1; recreation group 1.

MeB—Meridian loam, 2 to 6 percent slopes. This gently sloping soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 20 to 160 acres in size. Included in mapping are small areas of Billett soils.

Runoff is medium, and the erosion hazard is slight to moderate. Management practices are needed to control erosion, reduce runoff, conserve moisture, and maintain organic matter content.

Nearly all areas of this soil are used for crops. This soil is suited to all crops commonly grown in the county. It is also suited to trees and to wildlife habitat. It has slight or moderate limitations for nonfarm uses. Capability unit IIe–2; woodland suitability group 2o1; wildlife group 1; recreation group 1.

MeC2—Meridian loam, 6 to 12 percent slopes, eroded. This sloping soil is on stream terraces. Most areas are irregularly shaped and range from 6 to 40 acres in size. This soil has a profile similar to the one described as representative for the series, but it has a slightly thinner surface layer and is slightly shallower to sand.

Included with this soil in mapping are small areas of Billett soils. Also included are a few small areas of moderately steep Meridian soils.

Runoff is medium, and the erosion hazard is moderate. Management practices are needed to control erosion, reduce runoff, conserve moisture, and maintain organic matter content.

Most areas of this soil are used for crops. If properly managed, this soil is moderately well suited to all crops commonly grown in the county. It is also suited to trees and to wildlife habitat. This soil has slight or moderate limitations for nonfarm uses. Capability unit IIIe–2; woodland suitability group 2o1; wildlife group 1; recreation group 1.

MmA—Meridian loam, moderately well drained, 0 to 3 percent slopes. This nearly level and gently sloping soil is on broad stream terraces and outwash plains. Most areas are irregularly shaped and range from 8 to 50 acres in size. Some smaller areas are at the base of upland slopes and receive runoff, subsurface seepage, or both from the adjoining uplands. This soil has a profile similar to the one described as representative for the series, but it has mottles in the lower part of the subsoil.

Included with this soil in mapping are small areas of moderately well drained Billet soils and areas of Meridian and Shiffer soils.

Runoff is slow, and the erosion hazard is slight. This soil has a seasonal fluctuating water table at a depth of 3 to 5 feet. At times, as the water table lowers during the cropping season, less water is available in this soil than in nearby deep soils, and crops are slightly less productive than they are in the deep soils. Slight wetness in spring will affect tillage. Management practices are needed to conserve moisture and maintain organic matter content and tilth.

Nearly all areas of this soil are used for cultivated crops. This soil is suited to all crops commonly grown in the county. It has slight or moderate limitations for most nonfarm uses. Capability unit IIs–1; woodland suitability group 2o1; wildlife group 1; recreation group 1.

Merrillan Series

The Merillan series consists of somewhat poorly drained, nearly level and gently sloping soils on sandstone uplands. Native vegetation is mixed hardwood and pine forest, mainly northern red oak, white birch, white pine, and jack pine.

In a representative profile the surface layer is black sandy loam about 3 inches thick. The subsurface layer is grayish brown light loamy sand about 5 inches thick. The upper part of the subsoil is dark brown, mottled light sandy loam about 5 inches thick. Below this is about 5 inches of brown, mottled loamy sand. The lower part of the subsoil is light brownish gray, mottled heavy loam about 5 inches thick and olive gray, mottled heavy silty clay loam about 7 inches thick. The substratum is yellowish brown and very pale brown, soft, weathered sandstone and olive gray clayey shale. It is underlain by hard sandstone at a depth of about 40 inches.

Available water capacity and natural fertility are low in these soils. Permeability is moderate in the upper part of the soil and slow in the lower part. In undrained areas these soils are saturated at a depth of 1 to 3 feet during wet periods.

Most areas of these soils are in woods. Some, however, have been cleared for crops and pasture. If excess water is removed, these soils are suited to farming. The soils are also suited to pasture, woodland, and wildlife habitat. Limitations for many nonfarm uses are moderate or severe.

In this county Merrillan soils are mapped only in association with Fairchild soils.

Representative profile of Merrillan sandy loam is an uncultivated area of Fairchild and Merrillan soils, 2 to 6 percent slopes, 50 feet north and 550 feet west of the southeast corner of sec. 28, T. 27 N., R. 6 W.:

A1—0 to 3 inches; black (10YR 2/1) sandy loam; weak fine granular structure; friable; very strongly acid; clear smooth boundary.

A2—3 to 8 inches; grayish brown (10YR 5/2) light loamy sand; few medium distinct dark yellowish brown (10YR 4/4) mottles; weak thin platy structure; friable; very strongly acid; clear wavy boundary.

Bir—8 to 13 inches; dark brown (7.5YR 4/4) light sandy loam; common medium distinct grayish brown (10YR 5/2) mottles and common medium faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; strongly acid; clear wavy boundary.

A'2—13 to 18 inches; brown (10YR 5/3) loamy sand; common medium faint yellowish brown (10YR 5/4) mottles and common medium distinct brown (10YR 5/3) mottles; weak thin platy structure; very friable; strongly acid; clear smooth boundary.

IIB'21t—18 to 23 inches; light brownish gray (2.5Y 6/2) heavy loam; many medium distinct dark brown (7.5YR 4/4) mottles and many medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; moderate fine subangular blocky structure; firm; thin clay films on ped faces; very strongly acid; clear smooth boundary.

IIIB'22t—23 to 30 inches; olive gray (5Y 5/2) heavy silty clay loam; many medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6 and 5/8) mottles; moderate fine angular blocky structure; firm; thin clay films on ped faces; very strongly acid; clear smooth boundary.

IVC—30 to 40 inches; yellowish brown (10YR 5/4) and very pale brown (10YR 7/4) soft sandstone residuum that has thin strata of olive gray (5Y 5/2) shale; very strongly acid; abrupt smooth boundary.

R—40 inches; indurated sandstone.

Thickness of the solum typically is 20 to 40 inches, but it ranges from 20 to 50 inches. Thickness and arrangement of horizons vary greatly. The A1 horizon is black (10YR 2/1) or very dark gray (10YR 3/1) sandy loam or loamy fine sand. It ranges in thickness from 1 to 3 inches. In cultivated areas the Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) and ranges from 6 to 8 inches in thickness. The A2 horizon is grayish brown (10YR 5/2), brown (10YR 5/3), or pinkish gray (7.5YR 6/2). It is sandy loam, loamy sand, or loamy fine sand and ranges in thickness from 2 to 6 inches. In cultivated areas the A2 horizon is either thin or not present.

The Bir horizon is sandy loam or loamy fine sand. Where present, the A'2 horizon is sandy loam or loamy sand. The IIB'21t and IIIB'22t horizons range from gray (10YR 5/1) to olive (5Y 5/3). They are loam, clay loam, silty clay loam, or silty clay. The IIB'21t and IIIB'22t horizons have thin strata of silty clay or clay in places. The IVC horizon varies in thickness and composition, reflecting the variations in the sandstone and shale layers.

Merrillan soils are near Fairchild soils and formed in material similar to that in which Humbird soils formed. Merrillan soils have a finer texture than Fairchild soils. They have mottling higher in the solum and are more poorly drained than Humbird soils.

Morocco Series

The Morocco series consists of somewhat poorly drained, nearly level, sandy soils on stream terraces and outwash plains. Native vegetation is conifer and hardwood trees.

In a representative profile the surface layer is very dark grayish brown loamy sand about 7 inches thick. The subsoil is about 25 inches thick. It is brown, mottled loamy sand in the upper 9 inches and brown, mottled sand in the lower 16 inches. The substratum to a depth of about 60 inches is pale brown sand.

Available water capacity and natural fertility are low in these soils. Permeability is rapid. In undrained areas these soils are saturated at a depth of 1 to 3 feet during wet periods.

Some areas of these soils are used for crops, but large areas remain in woods. These soils are suited to farming if excess water is removed. They are also suited to wildlife habitat and woodland. Limitations for many nonfarm uses are severe.

Representative profile of Morocco loamy sand that has 0 to 2 percent slopes, in a cultivated field, 400 feet east and 1,220 feet south of the center of sec. 30, T. 27 N., R. 7 W.:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) when dry; weak medium granular structure; very friable; slightly acid; abrupt smooth boundary.

B21—7 to 16 inches; brown (10YR 5/3) loamy sand; many medium faint dark brown (7.5YR 4/4) and grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; very friable; strongly acid; clear smooth boundary.

B22—16 to 32 inches; brown (10YR 5/3) sand; many medium faint grayish brown (10YR 5/2) and dark brown (7.5YR 4/4) mottles and prominent strong brown (7.5YR 5/6 and 5/8) mottles; single grained; loose; strongly acid; gradual smooth boundary.

C—32 to 60 inches; pale brown (10YR 6/3) sand; single grained; loose; strongly acid.

Thickness of the solum ranges from 24 to 48 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark gray (10YR 4/1) and ranges from 6 to 8 inches in thickness. In uncultivated areas the A1 horizon is dark gray (10YR 4/1).

Morocco soils formed in material similar to that in which Friendship, Newson, and Plainfield soils formed. Morocco soils are somewhat poorly drained, Friendship soils are moderately well drained, Newson soils are poorly drained, and Plainfield soils are excessively drained.

Mo—Morocco loamy sand (0 to 2 percent slopes). This nearly level soil is on outwash plains and stream terraces. Most areas are irregularly shaped and range from 5 to 40 acres in size.

Included with this soil in mapping are small areas of Friendship and Newson soils. Also included are areas of Morocco soils that in places have finer textured layers or sandstone bedrock at a depth of 5 to 8 feet.

Runoff is slow or ponded, and the erosion hazard is slight. This soil receives runoff from adjoining areas, and it is commonly ponded during wet seasons and after heavy rains. Surface drainage removes excess water rapidly. Deep ditches and tile drains are used for internal drainage. If tile drains are used, care must be taken to prevent loose sand from entering the tile line. If this soil is overdrained, it becomes droughty. Crops grown in this soil are subject to frost damage. Management practices are needed to control drainage and supply regular additions of organic matter.

About half of the acreage of this soil is used for crops. The rest is in grass cover and hardwood forests or has been planted to pine plantations. This soil is not well suited to most crops commonly grown in the county. It is well suited to pasture, woodland, and wildlife habitat. It has severe limitations for many nonfarm uses. Capability unit IVw–5; woodland suitability group 3s2; wildlife group 6; recreation group 5.

Mt. Carroll Series

The Mt. Carroll series consists of well drained, nearly level to sloping, silty soils on ridges, valley slopes, and stream terraces. These soils formed in thick silt loam deposits. Native vegetation is mixed prairie grasses and scattered hardwood trees.

In a representative profile the surface layer is very dark brown silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is brown and dark brown silt loam about 31 inches thick. The substratum to a depth of about 60 inches is yellowish brown silt loam.

Available water capacity is very high in these soils, and natural fertility is high. Permeability is moderate.

Most areas of these soils are used for crops. A few small areas are in pasture or woods. Mt. Carroll soils are well suited or moderately well suited to farming. They are also suited to pasture and wildlife habitat. Woodland suitability is limited to conifers and a few hardwoods. Limitations for most nonfarm uses are slight or moderate.

Representative profile of Mt. Carroll silt loam, 2 to 6 percent slopes, in a cultivated area, 1,300 feet north and 400 feet east of the southwest corner of the NW¼ sec. 24, T. 25 N., R. 7 W.:

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

A2—9 to 13 inches; dark grayish brown (10YR 4/2) silt loam; weak medium platy structure parting to very fine subangular blocky; friable; very dark grayish brown (10YR 3/2) organic stains in root channels; medium acid; clear smooth boundary.

B1—13 to 18 inches; dark brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; few thin light gray (10YR 7/2) silt coatings on ped faces; strongly acid; clear smooth boundary.

B2t—18 to 38 inches; dark brown (10YR 4/3) heavy silt loam; moderate medium subangular blocky structure; firm; thin discontinuous clay films and few thin light gray (10YR 7/2) silt coatings on ped faces; very strongly acid; clear smooth boundary.

B3—38 to 44 inches; brown (10YR 5/3) silt loam; weak coarse subangular blocky structure; friable; strongly acid; clear smooth boundary.

C—44 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; medium acid.

Thickness of the solum ranges from 36 to 48 inches. The Ap horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) and is 6 to 9 inches thick. The A2 horizon is dark grayish brown (10YR 4/2) or brown (10YR 5/3). The B2t horizon is dark brown (10YR 4/3) or dark yellowish brown (10YR 4/4).

Mt. Carroll soils in this county are more acid in the subsoil and substratum than those within the defined range for the series, but this difference does not alter their usefulness and behavior.

Mt. Carroll soils are near Pillot and Seaton soils. Mt. Carroll soils formed in thicker silt loam deposits than Pillot soils. They have a darker A horizon than Seaton soils.

MrB—Mt. Carroll silt loam, 2 to 6 percent slopes. This gently sloping soil is mainly on broad ridgetops, but in some areas it is on the sides of ridges. Most areas are irregularly shaped and range from 30 to 120 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Mt. Carroll soils that have a thinner and lighter colored surface layer. Also included are areas of this soil that are underlain by sand or sandstone at a depth of 40 to 60 inches.

Runoff is medium, and the erosion hazard is slight. Management practices are needed to reduce runoff, control erosion, maintain organic matter content, and improve tilth.

All but a few small areas of this soil are used for crops. This soil is well suited to all crops commonly grown in the county, and it is suited to such specialty crops as snap beans, peas, and sweet corn. This soil is also suited to pasture, wildlife habitat, and some types of woodland, but because of its high productivity for crops, only very small areas are used for these purposes. This soil has slight or moderate limitations for most nonfarm uses. Capability unit IIe–1; woodland suitability group 2o1; wildlife group 1; recreation group 1.

MrC2—Mt. Carroll silt loam, 6 to 12 percent slopes, eroded. This sloping soil is mainly on the sides of ridges and on valley slopes. Smaller areas are on narrow crests of ridges. Most areas are irregularly shaped and range from 20 to 60 acres in size. This soil has a profile similar to the one described as representative for the series, but the surface layer is slightly thinner and lighter colored.

Included with this soil in mapping are small areas of Seaton soils. Also included are areas of this soil that are underlain by sandstone at a depth of 40 to 60 inches.

Runoff is rapid, and the erosion hazard is moderate to severe. Management practices are needed to reduce runoff, control erosion, maintain organic matter content, and improve tilth.

Most areas of this soil are used for crops. A few small areas are in pasture or woods. This soil is moderately well suited to all crops commonly grown in the county. It is also suited to pasture and some types of woodland. It has slight or moderate limitations for most nonfarm uses. Capability unit IIIe–1; woodland suitability group 2o1; wildlife group 1; recreation group 1.

Ms—Mt. Carroll silt loam, benches (0 to 2 percent slopes). This nearly level soil is on broad stream terraces. Most areas are irregularly shaped and range from 6 to 40 acres in size. This soil has a profile similar to the one described as representative for the series, but it is underlain by sand at a depth of 5 to 7 feet.

Included with this soil in mapping are small areas of Seaton soils. Also included are areas of this soil that are underlain by sand at as shallow a depth as 40 inches and other areas where the soil material is mottled below a depth of 36 inches.

Runoff is slow, and the erosion hazard is slight. Management practices are needed to maintain organic-matter content and improve tilth.

Nearly all areas of this soil are used for crops. This soil is well suited to crops commonly grown in the county. It is also suited to such specialty crops as green beans, peas, and sweet corn. This soil has

slight or moderate limitations for most nonfarm uses. Capability unit I–1; woodland suitability group 2o1; wildlife group 1; recreation group 1.

Newson Series

The Newson series consists of nearly level, poorly drained sandy soils in slight depressions on stream terraces. Native vegetation is grasses, shrubs, and trees that require large amounts of water.

In a representative profile the surface layer is black loamy sand about 9 inches thick. The substratum to a depth of about 60 inches is gray and light brownish gray sand.

Available water capacity and natural fertility are low in these soils. Permeability is rapid. Ground water is at or near the surface throughout the year in undrained areas.

In most areas of these soils the vegetation is alder or native grasses and shrubs that require large amounts of water. A few areas are used for crops or permanent pasture.

If excess water is removed, these soils are suited to farming. The soils are well suited to wetland wildlife habitat. They are generally poorly suited to woodland. Limitations for most nonfarm uses are severe.

Representative profile of Newson loamy sand that has 0 to 2 percent slopes, in a cultivated field, 100 feet north and 800 feet east of the southwest corner of the SE¼ sec. 24, T. 27 N., R. 8 W.:

Ap—0 to 9 inches; black (10YR 2/1) loamy sand; weak medium granular structure; very friable; strongly acid; clear smooth boundary.

C1g—9 to 25 inches; gray (10YR 5/1) sand; single grained; loose; strongly acid; clear smooth boundary.

C2—25 to 60 inches; light brownish gray (10YR 6/2) sand; single grained; loose; strongly acid.

Thickness of the A horizon ranges from 8 to 10 inches, and texture ranges from mucky loamy sand to sand. An A12g horizon is below the Ap or A1 horizon in places. It ranges from very dark gray (10YR 3/1) to dark gray (10YR 4/1) and has faint mottles. It is 5 to 7 inches thick. The C horizon has few to many high chroma mottles in places.

Newson soils are near Elm Lake, Friendship, Menahga, and Morocco soils. Newson soils formed in sandy outwash, and Elm Lake soils formed in sandstone residuum. Newson soils are poorly drained, Friendship soils are moderately well drained, Menahga soils are excessively drained, and Morocco soils are somewhat poorly drained.

Na—Newson loamy sand (0 to 2 percent slopes). This nearly level soil is in slight depressions on stream terraces and along drainageways. Most areas are long and narrow or irregularly shaped. They range from 10 to 20 acres in size.

Included with this soil in mapping are small areas of Morocco and Markey soils. Also included are areas of this soil that have a surface layer of sand or muck and areas that are underlain by loamy layers or sandstone at a depth of 40 to 60 inches.

Runoff is slow, and the erosion hazard is slight. This soil receives runoff from adjoining areas and is commonly ponded during wet seasons and after heavy rains. Surface drainage removes excess water rapidly. Deep ditches and tile drains are used for internal drainage. If tile drains are used, care must be taken to prevent loose sand from entering the tile line. If this soil is excessively drained, it becomes droughty. Crops grown on this soil are subject to frost damage. Management practices are needed to control drainage and supply regular additions of organic matter.

Some areas of this soil are used for crops, but most areas are in water-tolerant grasses, shrubs, or trees. This soil is not well suited to farming, and even if it is drained, the selection of plants is limited and crop yields are moderately low. This soil has severe limitations for most nonfarm uses. Capability unit IVw–5; woodland suitability group 4w1; wildlife group 7; recreation group 6.

Norden Series

The Norden series consists of well drained, sloping to steep loamy soils that are underlain by glauconitic sandstone. These soils are on side slopes and ridgetops on sandstone uplands. Native vegetation is hardwood trees.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is about 22 inches thick. It is dark yellowish brown silt loam in the upper part, olive brown loam in the middle part, and olive very fine sandy loam in the lower part. The substratum to a depth of about 60 inches is olive brown and olive fine grained glauconitic sandstone.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderate.

In most areas where they are not too steep, these soils are cultivated. Also, areas are used for pasture, woodland, and wildlife habitat. Areas of sloping and moderately steep soils range from moderately well suited to not well suited to farming. These areas are suited to wildlife habitat and woodland. Areas of steep soils are better suited to woodland, permanent pasture, or wildlife habitat. Limitations for many nonfarm uses are moderate or severe.

Representative profile of Norden silt loam, 12 to 20 percent slopes, eroded, in a cultivated area, 950 feet east and 100 feet north of the southwest corner of the SE¼ sec. 28, T. 25 N., R. 9 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) when dry; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

B1—8 to 14 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

B2t—14 to 24 inches; olive brown (2.5Y 4/4) loam; moderate fine subangular blocky structure; firm; thin discontinuous clay films; few fine sandstone fragments; strongly acid; clear smooth boundary.

B3—24 to 30 inches; olive (5Y 4/4 and 5/4) very fine sandy loam; weak fine subangular blocky structure; friable; common fine sandstone fragments; medium acid; clear smooth boundary.

C—30 to 60 inches; olive (5Y 4/4) and olive brown (2.5Y 4/4) weakly cemented fine grained glauconitic sandstone; medium acid in the upper part and mildly alkaline in the lower part.

Thickness of solum and depth to underlying sandstone range from 26 to 40 inches. Texture of the Ap horizon is

silt loam or loam. The A1 horizon, where present, is 2 to 4 inches thick and is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). The A2 horizon, where present, is brown (10YR 5/3). It ranges in thickness from 2 to 6 inches. The texture of the B3 horizon is very fine sandy loam or loam. The C horizon contains strata of strongly cemented sandstone.

Norden soils are near Gale, Seaton, and Urne soils. Norden soils are underlain by glauconitic sandstone, and Gale soils are underlain by sandstone that contains no glauconite. Norden soils formed in residuum from glauconitic sandstone, and Seaton soils formed in thick silty deposits. Norden soils are more silty and less sandy in the upper part of the solum than Urne soils.

NrC2—Norden silt loam, 6 to 12 percent slopes, eroded. This sloping soil is on the crests and at breaks below the crests of moderately narrow ridgetops. Most areas are long and narrow and range from 10 to 40 acres in size. This soil has a profile similar to the one described as representative for the series, but it is slightly deeper to sandstone.

Included with this soil in mapping are small areas of soils that are more than 40 inches deep to sandstone. Also included are areas of severely eroded Norden soils.

Runoff is medium, and the erosion hazard is moderate. Management practices are needed to control erosion, reduce runoff, conserve moisture, maintain organic matter content, and improve tilth.

Most areas of this soil are used for crops. This soil is moderately well suited to most crops commonly grown in the county. It is also suited to pasture, woodland, or wildlife habitat. It has moderate or severe limitations for many nonfarm uses. Capability unit IIIe–2; woodland suitability group 2o1; wildlife group 1; recreation group 1.

NrD2—Norden silt loam, 12 to 20 percent slopes, eroded. This moderately steep soil is on sides of sandstone ridges. Most areas are long and narrow and range from 10 to 60 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Urne soils and soils that are more than 40 inches deep to sandstone. Also included are small areas of severely eroded Norden soils.

Runoff is rapid, and the erosion hazard is severe. Management practices are needed to control erosion, reduce runoff, conserve moisture, maintain organic matter content, and improve tilth.

About half of the acreage of this soil is used for crops. The rest is used for pasture, woodland, or wildlife habitat. This soil is not well suited to cultivated crops. It is suited to forage crops, pasture, woodland, or wildlife habitat. It has severe limitations for most nonfarm uses. Capability unit IVe–2; woodland suitability group 2r1; wildlife group 1; recreation group 1.

NrE2—Norden silt loam, 20 to 30 percent slopes, eroded. This steep soil is on sides of sandstone ridges. Most areas are long and narrow or irregularly shaped. They range from 10 to 70 acres in size. This soil has a profile similar to the one described as representative for the series, but it is slightly thinner.

Included with this soil in mapping are small areas of Urne soils. Also included are small areas of severely eroded Norden soils.

Runoff is very rapid, and the erosion hazard is very severe. Management practices are needed to maintain plant cover, control erosion, and reduce runoff.

Most areas of this soil are used for pasture, woodland, or wildlife habitat. This soil is generally unsuited to cultivated crops. It is suited to hay crops, pasture, woodland, or wildlife habitat. It has severe limitations for most nonfarm uses. Capability unit VIe–2; woodland suitability group 2r1; wildlife group 1; recreation group 1.

Northfield Series

The Northfield series consists of well drained, gently sloping to very steep, silty soils that are underlain by platy sandstone at a depth of less than 20 inches (fig. 7). These soils are on sandstone ridges. Native vegetation is hardwood trees.

In a representative profile the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 9 inches thick. It is dark brown silt loam in the upper part and dark yellowish brown heavy silt loam in the lower part. Hard, platy sandstone is at a depth of about 16 inches.

Available water capacity is low in these soils, and natural fertility is medium. Permeability is moderate.

Most areas of gently sloping and sloping Northfield soils are used for crops. Areas of steeper soils remain

Figure 7.—**Profile of Northfield silt loam.**

in woods or are used for permanent pasture. Gently sloping and sloping soils range from moderately well suited to not well suited to farming. Steeper soils are better suited to woodland, permanent pasture, or wildlife habitat. Limitations for many nonfarm uses are severe.

Representative profile of Northfield silt loam, 2 to 6 percent slopes, in a cultivated field, 450 feet north and 100 feet west of the southeast corner of sec. 20, T. 27 N., R. 10 W.:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) when dry; weak medium subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

B1—7 to 10 inches; dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

B2t—10 to 16 inches; dark yellowish brown (10YR 4/4) heavy silt loam; moderate medium subangular blocky structure; firm; thin patchy clay films; slightly acid; abrupt smooth boundary.

R—16 inches; yellow (10YR 7/6) and yellowish brown (10YR 5/6) hard platy sandstone.

Thickness of the solum and depth to sandstone range from 12 to 20 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) in places. In uncultivated areas there is a thin black (10YR 2/1) A1 horizon and a brown (10YR 5/3) platy A2 horizon. In places a few sandstone fragments are on the surface and throughout the profile.

Northfield soils are near Elkmound, Gale, and Urne soils. Northfield soils contain more silt and clay than Elkmound soils. Their combined A and B horizons are thinner than those in Gale soils. Northfield soils have more silt in the A and B horizons than Urne soils, and they lack the underlying fine grained glauconitic sandstone of Urne soils.

NtB—Northfield silt loam, 2 to 6 percent slopes. This gently sloping soil is on ridgetops. Most areas are long and narrow or irregularly shaped and range from 10 to 60 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Elkmound and Gale soils. Also included are a few small areas of Northfield soils that have slopes of less than 2 percent.

Runoff is slow or medium, and the erosion hazard is moderate. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion, reduce runoff, conserve moisture, maintain organic matter content, and improve tilth.

Most areas of this soil are used for crops, but a few narrow ridgetops are in grass or trees. This soil is moderately well suited to most crops commonly grown in the county. It is also suited to pasture, woodland, and wildlife habitat. It has severe limitations for many nonfarm uses. Capability unit IIIe–3; woodland suitability group 3d1; wildlife group 4; recreation group 3.

NtC2—Northfield silt loam, 6 to 12 percent slopes, eroded. This sloping soil is on ridgetops. Most areas are long and narrow and range from 8 to 40 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is slightly lighter colored.

Included with this soil in mapping are small areas of Elkmound loam. Also included are areas of this soil that have small sandstone fragments on the surface and throughout the profile.

Runoff is medium, and the erosion hazard is moderate. Low available water capacity limits crop yields during most seasons. Management practices are needed to control erosion, reduce runoff, conserve moisture, maintain organic matter content, and improve tilth.

About two-thirds of the acreage of this soil is used for crops. The rest is in grass and trees. This soil is not well suited to cultivated crops commonly grown in the county. It is suited to pasture, woodland, and wildlife habitat. It has severe limitations for many nonfarm uses. Capability unit IVe–3; woodland suitability group 3d1; wildlife group 4; recreation group 3.

NtD2—Northfield silt loam, 12 to 20 percent slopes, eroded. This moderately steep soil is on ridges and hillsides on sandstone uplands. Most areas are long and narrow and range from 8 to 50 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is slightly lighter colored. Sandstone fragments are common on the surface of this soil and throughout the profile.

Included with this soil in mapping are areas of Elkmound soils. Also included are areas of severely eroded Northfield soils and areas where sandstone fragments are on the surface and throughout the profile.

Runoff is rapid, and the erosion hazard is severe. Management practices are needed to maintain plant cover, control erosion, reduce runoff, and conserve moisture.

Most areas of this soil are in grass or trees. This soil is generally unsuited to cultivated crops. It is better suited to hay, pasture, woodland, or wildlife habitat. It has severe limitations for most nonfarm uses. Capability unit VIe–3; woodland suitability group 3d2; wildlife group 4; recreation group 3.

NtE2—Northfield silt loam, 20 to 30 percent slopes, eroded. This steep soil is on ridges and hillsides on sandstone uplands. Most areas are long and narrow and range from 10 to 45 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is slightly thinner and lighter colored.

Included with this soil in mapping are small areas of Elkmound soils. Also included are small areas of severely eroded Northfield soils and areas where sandstone fragments are on the surface and throughout the profile.

Runoff is very rapid, and the erosion hazard is very severe. Management practices are needed to maintain plant cover and control erosion.

Most areas of this soil are used for pasture. This soil is not suited to cultivated crops. It is better suited to pasture, woodland, or wildlife habitat. It has severe limitations for most nonfarm uses. Capability unit VIIe–3; woodland suitability group 3d2; wildlife group 4; recreation group 3.

NtF—Northfield silt loam, 30 to 45 percent slopes. This very steep soil is on hillsides and escarpments. Most areas are long and narrow and range from 10 to

65 acres in size. The profile of this soil is similar to the one described as representative for the series, but this soil has a thinner surface layer and is shallower to sandstone. Included in mapping are areas of Elkmound soils.

Runoff is very rapid, and the erosion hazard is very severe. Management practices are needed to maintain plant cover and control erosion.

Most areas of this soil are wooded. This soil is unsuited to cultivated crops. It is better suited to woodland or wildlife habitat. It has severe limitations for nonfarm uses. Capability unit VIIe–3; woodland suitability group 3d3; wildlife group 4; recreation group 3.

Orion Series

The Orion series consists of somewhat poorly drained, nearly level, silty soils in drainageways and on stream bottoms. Native vegetation is mainly elm, red maple, cottonwood, and black willow.

In a representative profile the surface layer is dark grayish brown silt loam about 8 inches thick. The substratum to a depth of about 36 inches is dark grayish brown, mottled silt loam. Below this is a buried surface layer of black silt loam about 12 inches thick. The substratum to a depth of about 60 inches below this is gray, mottled silt loam.

Available water capacity is very high in these soils, and natural fertility is high. Permeability is moderate. Orion soils flood in spring or following heavy rainfall. In undrained areas these soils are saturated at a depth of 1 to 3 feet during wet periods.

Most areas of these soils are used for crops. A few areas remain in woods. Orion soils are suited to farming if excess water is removed. They are also suited to wildlife habitat and woodland. Limitations for many nonfarm uses are severe.

Representative profile of Orion silt loam that has 0 to 2 percent slopes, in a cultivated field, 50 feet south and 200 feet east of the northwest corner of sec. 13, T. 26 N., R. 8 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak very thick platy structure parting to weak medium subangular blocky; friable; slightly acid; abrupt smooth boundary.

C1—8 to 36 inches; dark grayish brown (10YR 4/2) silt loam; many medium prominent dark yellowish brown (10YR 3/4) and dark brown (7.5YR 4/4) mottles; thin layers of very dark grayish brown (10YR 3/2) and brown (10YR 5/3) silt loam; weak thin platy structure; friable; slightly acid; clear smooth boundary.

Ab—36 to 48 inches; black (10YR 2/1) silt loam; many medium prominent dark gray (10YR 4/1) and dark reddish brown (5YR 3/4) mottles; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.

IIC2—48 to 60 inches; gray (10YR 5/1) silt loam; many medium prominent dark brown (7.5YR 4/4) and dark gray (10YR 4/1) mottles; weak medium subangular blocky structure; friable; medium acid.

Thickness of the silty deposits is more than 60 inches. Depth to the buried Ab horizon ranges from 20 to 40 inches. The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). In places thin sandy or loamy overwash is on the surface. Layers of thin fine sand are in the profile in places.

Orion soils are near Arenzville, Ettrick, and Otter soils. Orion soils are more highly mottled, especially in the upper part of the profile, than Arenzville soils. Orion soils lack the thick black A horizon and the gleyed B horizon of Ettrick soils. They formed in material similar to that in which Otter soils formed, but the Orion soils are somewhat poorly drained and the Otter soils are poorly drained.

On—Orion silt loam (0 to 2 percent slopes). This somewhat poorly drained soil is in drainageways and stream bottoms. Most areas are long and narrow. They range from 10 to 45 acres in size.

Included with this soil in mapping are small areas of Arenzville soils and areas of a soil that is similar to Orion soils but is poorly drained.

Runoff is slow, and the erosion hazard is slight. This soil is subject to flooding, and water ponds on the surface. Surface drainage removes excess water rapidly. Deep ditches and tile drains are used for internal drainage. Management practices are needed to reduce flooding and remove excess water.

Most areas of this soil are used for crops. Areas in the narrower drainageways and some lower lying areas remain in grass. If properly drained and protected from flooding, this soil is suited to most crops commonly grown in the county. It is also suited to pasture, woodland, and wildlife habitat. It has severe limitations for many nonfarm uses. Capability unit IIw–11; woodland suitability group 3o2; wildlife group 6; recreation group 7.

Otter Series

The Otter series consists of poorly drained, nearly level, silty soils on stream bottoms. Native vegetation is grasses, sedges, and shrubs that require large amounts of water.

In a representative profile the surface layer is about 28 inches thick. It is very dark grayish brown, mottled silt loam in the upper part; very dark gray, mottled silt loam in the middle; and black, mottled silt loam in the lower part. The substratum to a depth of about 60 inches is gray and olive gray, mottled silt loam.

Permeability is moderate in these soils. Available water capacity is very high, and natural fertility is high. In undrained areas, ground water is at or near the surface throughout the year.

Most areas of these soils are in permanent grass and are used for pasture or wildlife habitat. A few areas have been drained and are used for crops. These soils are suited to row crops and forage production if drained. They are poorly suited to woodland. Limitations for most nonfarm uses are severe.

Representative profile of Otter silt loam, overwash, that has 0 to 2 percent slopes, in a cultivated area, 200 feet north and 775 feet west of the center of sec. 30, T. 26 N., R. 7 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; many medium distinct grayish brown (10YR 5/2) and dark brown (7.5YR 4/4) mottles; weak fine subangular blocky structure; friable; medium acid; abrupt smooth boundary.

A12—8 to 15 inches; very dark gray (10YR 3/1) silt loam; many medium distinct dark reddish brown (5YR 2/2) mottles; weak medium platy structure part-

ing to weak very fine subangular blocky; friable; few thin dark grayish brown (10YR 4/2) strata of alluvium; slightly acid; abrupt smooth boundary.

A13—15 to 21 inches; black (10YR 2/1) silt loam; massive; friable; slightly acid; clear smooth boundary.

A14—21 to 28 inches; black (10YR 2/1) silt loam; common coarse prominent dark reddish brown (5YR 3/4) mottles; massive; friable; slightly acid; clear smooth boundary.

C1g—28 to 42 inches; gray (5Y 6/1) silt loam; many medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; massive; friable; slightly acid; clear smooth boundary.

C2g—42 to 60 inches; olive gray (5Y 5/2) silt loam; many medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; massive; friable; slightly acid.

Thickness of the A horizon ranges from 24 to 40 inches. The A horizon is black (10YR 2/1 or N 2/0), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2).

Otter soils are near Ettrick and Orion soils. They lack the Bt horizon of Ettrick soils. Otter soils are poorly drained, and Orion soils are somewhat poorly drained.

Or—Otter silt loam, overwash (0 to 2 percent slopes). This nearly level soil is on flood plains. Most areas are long and narrow and range from 10 to 60 acres in size.

Included with this soil in mapping are small areas of Ettrick and Orion soils. Also included are areas of Otter soils that have a surface layer of muck and other areas that have thin strata of sandy loam in the surface layer.

Runoff is very slow, and the erosion hazard is slight. Management practices are needed to remove excess water and provide protection from flooding.

If protected from flooding and adequately drained, this soil is suited to cultivated crops. It has severe limitations for most nonfarm uses. Capability unit IIw–1; woodland suitability group 2w1; wildlife group 7; recreation group 7.

Otterholt Series

The Otterholt series consists of well drained, gently sloping and sloping soils on till plains (fig. 8). These soils formed in thick silt loam deposits over fine sandy loam glacial till. Native vegetation is hardwood trees, mainly northern red oak, sugar maple, and basswood.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is dark yellowish brown silt loam about 26 inches thick. The substratum to a depth of about 60 inches is dark brown silt loam in the upper 12 inches and reddish brown fine sandy loam below.

Available water capacity is very high in these soils, and natural fertility is high. Permeability is moderate.

Most areas of these soils are used for crops. A few small areas are in pasture or trees. Otterholt soils are well suited or moderately well suited to farming if erosion is controlled. They are also suited to pasture and woodland. Limitations for most nonfarm uses are slight or moderate.

Representative profile of Otterholt silt loam, 6 to 12 percent slopes, eroded, in an uneroded area in a cultivated field, 1,200 feet south and 50 feet east of the northwest corner of sec. 9, T. 27 N., R. 6 W.:

Figure 8.—**Profile of Otterholt silt loam.**

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) when dry; weak fine subangular blocky structure; friable; neutral; clear abrupt boundary.

A2—8 to 12 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium platy structure; friable; slightly acid; clear irregular boundary.

A&B—12 to 18 inches; dark grayish brown (10YR 4/2) tongues of silt loam (A2) make up about 60 percent of the matrix; moderate medium platy structure; dark yellowish brown (10YR 4/4) silt loam (B2t); moderate fine subangular blocky structure; friable; thin bands of strong brown (7.5YR 5/6) border the tongues of A2 material; slightly acid; abrupt irregular boundary.

B&A—18 to 31 inches; dark yellowish brown (10YR 4/4) silt loam (B2t); weak coarse prismatic structure parting to moderate medium subangular blocky; friable; dark grayish brown (10YR 4/2) tongues of loam (A2) make up about 20 percent of the matrix; weak medium platy structure; friable; thin discontinuous clay films on ped faces with blocky structure; very strongly acid; clear smooth boundary.

B2t—31 to 38 inches; dark yellowish brown (10YR 4/4) heavy silt loam; moderate medium subangular blocky structure; firm; thin light gray (10YR 7/2) silt coatings and thin discontinuous clay films on ped faces; very strongly acid; clear smooth boundary.

B3t—38 to 44 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; few thin discontinuous clay films on ped faces; very strongly acid; clear smooth boundary.
C1—44 to 56 inches; dark brown (10YR 4/3) silt loam; massive; friable; strongly acid; clear smooth boundary.
IIC2—56 to 60 inches; reddish brown (5YR 4/4) fine sandy loam glacial till; massive; friable; few to many fine pebbles; medium acid.

Thickness of the solum ranges from 30 to 48 inches. Thickness of the silt loam deposit over glacial till ranges from 30 to 60 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). The A2 horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). Texture of the IIC2 horizon is fine sandy loam or light loam.

Otterholt soils are near Fallcreek variant soils. They formed in material similar to that in which the Seaton soils formed. Otterholt soils have less sand throughout the A and B horizons than Fallcreek soils. Unlike the Seaton soils, Otterholt soils have extensions of the A2 horizon into the B horizon.

OsB—Otterholt silt loam, 2 to 6 percent slopes. This gently sloping soil is on broad ridges on glacial till plains. Most areas are irregularly shaped and range from 20 to 80 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is thicker.

Included with this soil in mapping are a few small areas of moderately well drained Otterholt soils. Most of these areas are indicated by wet spot symbols on the soil map. Also included are a few areas where Otterholt soils have a surface layer of loamy sand or sandy loam. These areas are indicated by sand spot symbols on the soil map.

Runoff is medium, and the erosion hazard is slight. Management practices are needed to reduce runoff, control erosion, and maintain organic-matter content and good tilth.

Most areas of this soil are used for crops. If erosion is controlled and tilth is maintained, this soil is well suited to the crops commonly grown in the county. It is also well suited to pasture and woodland. It has slight or moderate limitations for most nonfarm uses. Capability unit IIe–1; woodland suitability group 1o1; wildlife group 1; recreation group 1.

OsC2—Otterholt silt loam, 6 to 12 percent slopes, eroded. This sloping soil is on the crests and sides of road ridges on glacial plains. Most areas are irregularly shaped and range from 10 to 60 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are a few small areas of moderately well drained Otterholt soils. These areas are indicated by wet spot symbols on the soil map. Also included are areas of Otterholt soils that have a surface layer of loamy sand or sandy loam. These areas are indicated by sand spot symbols on the soil map.

Runoff is medium, and the erosion hazard is moderate. Management practices are needed to reduce runoff, control erosion, and maintain organic matter content and good tilth.

Most areas of this soil are used for pasture and crops. A few small areas remain in woods. If erosion is controlled, this soil is moderately well suited to crops. It is well suited to woodland. This soil has slight or moderate limitations for most nonfarm uses. Capability unit IIIe–1; woodland suitability group 1o1; wildlife group 1; recreation group 1.

Pillot Series

The Pillot series consists of well drained, gently sloping soils on outwash plains and stream terraces. Native vegetation is prairie grasses.

In a representative profile the surface layer is about 12 inches thick. It is very dark brown silt loam in the upper 9 inches and dark brown silt loam in the lower 3 inches. The subsoil is about 26 inches thick. It is dark yellowish brown silt loam in the upper part, dark yellowish brown heavy silt loam in the middle, and yellowish brown sandy loam in the lower part. The substratum to a depth of about 60 inches is very pale brown fine and medium sand.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderate in the subsoil and rapid in the substratum.

Most areas of these soils are used almost entirely for crops. These soils are well suited to cultivated crops. Limitations for most nonfarm uses are slight or moderate.

Representative profile of Pillot silt loam, 2 to 6 percent slopes, in a cultivated field, 200 feet north and 300 feet west of the southeast corner of the NE¼ sec. 12, T. 25 N., R. 7 W.:

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam; moderate medium granular structure; friable; neutral; abrupt smooth boundary.
A3—9 to 12 inches; dark brown (10YR 3/3) silt loam; weak medium platy structure; friable; strongly acid; clear smooth boundary.
B1—12 to 16 inches; dark yellowish brown (10YR 3/4) silt loam; weak medium subangular blocky structure; friable; strongly acid; clear smooth boundary.
B2t—16 to 34 inches; dark yellowish brown (10YR 4/4) heavy silt loam; moderate medium subangular blocky structure; firm; thin patchy clay films; strongly acid; gradual smooth boundary.
IIB3—34 to 38 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; friable; strongly acid; gradual smooth boundary.
IIC—38 to 60 inches; very pale brown (10YR 7/4) fine and medium sand; single grained; loose; medium acid.

Thickness of the solum ranges from 24 to 45 inches. Thickness of the silty mantle ranges from 20 to 40 inches. The Ap or A1 horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The upper part of the B2t horizon is heavy silt loam or silty clay loam. In places the lower part of the B2t horizon is loam or light clay loam. The IIB3 horizon is sandy loam or loam. The IIC horizon is sand or loamy sand.

Pillot soils in this county contain less clay in the subsoil and are more acid than those in the defined range for the series, but this difference does not alter their usefulness and behavior.

Pillot soils are near Dakota; Mt. Carroll, benches; Tell; and Whitehall variant soils. Pillot soils are more silty and have less sand in the upper part of the solum than Dakota soils. They have a thinner solum than Mt. Carroll, benches, and Whitehall soils. Pillot soils have a thicker and darker colored A horizon than Tell soils.

PcB—Pillot silt loam, 2 to 6 percent slopes. This gently sloping soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range

from 20 to 160 acres in size. Included in mapping are small areas of Dakota and Tell soils.

Runoff is slow, and the erosion hazard is slight. Management practices are needed to reduce runoff, control erosion, and maintain organic matter content and good tilth.

Nearly all areas of this soil are used for crops. This soil is well suited to all crops commonly grown in the county, including specialty crops. If properly managed, it is highly productive. This soil is also suited to pasture and wildlife habitat. It has slight or moderate limitations for most nonfarm uses. Capability unit IIe–2; not placed in a woodland suitability group; wildlife group 5; recreation group 1.

Plainbo Series

The Plainbo series consists of excessively drained, gently sloping to very steep, sandy soils underlain by sandstone. Native vegetation is scrub oak and jack pine.

In a representative profile the surface layer is dark grayish brown loamy sand about 7 inches thick. The subsoil is about 14 inches thick. It is dark yellowish brown loamy sand in the upper part and dark yellowish brown sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand in the upper 8 inches and light yellowish brown weakly cemented sandstone below.

Available water capacity and natural fertility are low in these soils. Permeability is rapid.

In places areas of gently sloping Plainbo soils are used for crops, but some areas remain in native woods or are planted to pine trees. Areas of gently sloping to very steep soils are used for permanent pasture, woodland, or wildlife habitat. Gently sloping soils are not well suited to cultivated crops unless they are irrigated. Other areas are generally unsuited to cultivated crops. Plainbo soils are well suited to plants, such as pine trees, that require little water. Limitations for many nonfarm uses are slight to severe.

Representative profile of Plainbo loamy sand, 6 to 12 percent slopes, eroded, in a cultivated field, 300 feet south and 300 feet east of the northwest corner of sec. 10, T. 27 N., R. 8 W.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loamy sand; weak medium granular structure; very friable; medium acid; abrupt smooth boundary.

B2—7 to 13 inches; dark yellowish brown (10YR 3/4) loamy sand; weak medium subangular blocky structure; very friable; strongly acid; clear smooth boundary.

B3—13 to 21 inches; dark yellowish brown (10YR 4/4) medium sand; single grained; loose; strongly acid; clear smooth boundary.

C1—21 to 29 inches; yellowish brown (10YR 5/4) medium sand; single grained; loose; medium acid; abrupt smooth boundary.

C2—29 to 60 inches; light yellowish brown (10YR 6/4) weakly cemented sandstone.

Sandstone is at a depth of 20 to 40 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). In uncultivated areas there is an A1 and an A2 horizon. The A1 horizon is 1 to 4 inches thick and is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). The A2 horizon is 2 to 4 inches thick and is grayish brown (10YR 5/2), light brownish gray (10YR 6/2), or pale brown (10YR 6/3).

Plainbo soils are near Boone, Eleva, and Plainfield soils. Unlike Boone soils, Plainbo soils have a solum that is more than 5 percent weatherable minerals. Plainbo soils are coarser textured than Eleva soils, and they lack the horizon of clay accumulation of the Eleva soils. Plainbo soils formed partly or entirely in sandstone residuum, while Plainfield soils formed in deep sandy outwash.

PdB—Plainbo loamy sand, 2 to 6 percent slopes. This gently sloping soil is on ridgetops on sandstone uplands and on sandstone hills near sandy stream terraces and outwash plains. Most areas are irregularly shaped and range from 10 to 80 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is slightly darker and thicker. Included in mapping are small areas of Plainfield soils.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. It is better to plant early in spring before the soil has a chance to dry out than to plant later when the soil is drier. Management practices are needed to supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

About two-thirds of the acreage of this soil is used for crops. This soil is not well suited to most crops commonly grown in the county. Because of low available water capacity, deep rooted crops such as alfalfa-brome grass grow better than other crops. Supplemental irrigation is necessary for dependable crop production. This soil is well suited to pine trees. It has slight to severe limitations for many nonfarm uses. Capability unit IVs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

PdC2—Plainbo loamy sand, 6 to 12 percent slopes, eroded. This sloping soil is on ridges on sandstone uplands and on sandstone hills near stream terraces and outwash plains. Most areas are long and narrow or irregularly shaped. They range from 4 to 60 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Elkmound and Plainfield soils. Also included are some areas of slightly steeper Plainbo soils.

Runoff is medium, and the erosion hazard is moderate. This soil is subject to soil blowing. Management practices are needed to conserve moisture, maintain plant cover, and control erosion and soil blowing.

Most areas of this soil have been used for crops in the past, but many areas now have been planted to pine trees. This soil is generally unsuited to cultivated crops. Most areas that are used for crops are in hay. This soil is also used for woodland and wildlife habitat. It has slight to severe limitations for many nonfarm uses. Capability unit VIs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

Plainfield Series

The Plainfield series consists of excessively drained, nearly level to sloping, sandy soils on stream terraces and outwash plains. Native vegetation is hardwood and conifer trees.

In a representative profile the surface layer is dark grayish brown loamy sand about 6 inches thick. The subsoil is about 23 inches thick. It is dark brown light loamy sand in the upper part and dark yellowish brown sand in the lower part. Below this to a depth of about 60 inches is yellowish brown and light yellowish brown fine and medium sand.

Available water capacity and natural fertility are low in these soils. Permeability is rapid.

Most areas of these soils are used for crops, but many areas are planted to pine trees or are used for homesites. Plainfield soils are not well suited to farming, and crop production is generally low where these soils are not irrigated. These soils are well suited to plants such as pine trees that require little water. Limitations for many nonfarm uses are slight or moderate.

Representative profile of Plainfield loamy sand, 1 to 6 percent slopes, in a cultivated field, 100 feet north and 100 feet west of the center of sec. 24, T. 26., R. 10 W.:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loamy sand; weak fine granular structure; very friable; strongly acid; abrupt smooth boundary.

B2—6 to 15 inches; dark brown (10YR 4/3) light loamy sand; weak fine subangular blocky structure; very friable; strongly acid; gradual wavy boundary.

B3—15 to 29 inches; dark yellowish brown (10YR 4/4) medium and fine sand; single grained; loose; medium acid; gradual wavy boundary.

C1—29 to 36 inches; yellowish brown (10YR 5/4) medium and fine sand; single grained; loose; medium acid; gradual smooth boundary.

C2—36 to 60 inches; light yellowish brown (10YR 6/4) fine and medium sand; single grained; loose; medium acid.

Thickness of the solum ranges from 18 to 34 inches. The Ap horizon is dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), or dark brown (10YR 4/3). In uncultivated areas the A1 horizon is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) and is 1 to 4 inches thick. In places the C horizon contains small amounts of fine gravel.

Plainfield, Friendship, Gotham, Menahga, Morocco, Plainbo, and Sparta soils all formed in sandy sediment. Plainfield soils are excessively drained, Friendship soils are moderately well drained, and Morocco soils are somewhat poorly drained. Plainfield soils lack the Bt horizon of Gotham soils. They have warmer temperatures than those of Menahga soils. Plainfield soils formed in thicker sand deposits than the somewhat similar Plainbo soils, which are underlain by sandstone at a depth of less than 40 inches. Plainfield soils have a thinner and lighter colored A horizon than Sparta soils.

PfB—Plainfield loamy sand, 1 to 6 percent slopes. This nearly level and gently sloping soil is on broad stream terraces and outwash plains. Most areas are irregularly shaped and range from 10 to 200 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Gotham and Sparta soils and Plainfield, loamy substratum, soils.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. It is better to plant early in spring before the soil has a chance to dry out than to plant later. Management practices are needed to supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

About two-thirds of the acreage of this soil is used for crops. The rest is in native scrub oak or jack pine or has been planted to pine trees. This soil is not well suited to cultivated crops. It is suited to irrigation and can be intensively cropped if properly irrigated. This soil is well suited to pine trees. It has slight or moderate limitations for many nonfarm uses. Capability unit IVs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

PfC2—Plainfield loamy sand, 6 to 12 percent slopes, eroded. This sloping soil is on stream terraces, on outwash plains, and at the base of steeper upland soils. Most areas are irregularly shaped and range from 8 to 100 acres in size. This soil is similar to the one described as representative for the series, but it has less fine material in the subsoil and in most areas plowing has exposed lighter colored subsoil material.

Included with this soil in mapping are small areas of Gotham, Plainbo, Plainfield, and Menahga soils.

Runoff is medium, and the erosion hazard is moderate. This soil is subject to soil blowing. Available water capacity is low. It is better to seed for pasture early in spring on this soil than to do it later. Management practices are needed to conserve moisture, maintain plant cover, reduce runoff, and control erosion.

Most areas of this soil at one time were used for crops, but many areas are now planted to pine trees. Some areas are in grass cover or hay. Some forage crops for hay or pasture are grown, but production is generally poor. Because of the low available water capacity and soil blowing hazard, this soil is generally unsuited to row crops. It is better suited to pine trees or other vegetation that does not require much water. It has slight or moderate limitations for many nonfarm uses. Capability unit VIs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

PlB—Plainfield loamy sand, loamy substratum, 1 to 6 percent slopes. This nearly level and gently sloping soil is on stream terraces and outwash plains adjacent to the surrounding upland soils. Most areas are irregularly shaped and range from 10 to 60 acres in size. This soil has a profile similar to the one described as representative for the series, but it has a loamy layer 2 to 12 inches thick at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Gotham and Plainfield soils. Also included are areas of this soil that have a surface layer of sand and other areas where the substratum is clayey.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop production most years. It is better to plant early in spring before the soil has a chance to dry out than to plant later. Management practices are needed to supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most areas of this soil are either used for crops or are covered with grass. This soil is not well suited to cultivated crops. Because of the underlying loamy

layer, this soil has slightly higher available water capacity than the representative Plainfield soil. This results in slightly higher crop yields, especially in such deep rooted crops as alfalfa. This soil is suited to irrigation and can be intensively cropped if properly irrigated. This soil is also suited to pine trees. Some areas are used for homesites. In places the loamy layer in the substratum restricts movement of effluent from septic tank absorption fields. This soil has slight or moderate limitations for many nonfarm uses. Capability unit IVs–3; woodland suitability group 3o1; wildlife group 3; recreation group 4.

PlC2—Plainfield loamy sand, loamy substratum, 6 to 12 percent slopes, eroded. This sloping soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 8 to 45 acres in size. This soil has a profile similar to the one described as representative for the series, but it has a loamy layer about 2 to 12 inches thick in the sandy substratum at a depth of 40 to 60 inches.

Included with this soil in mapping are areas of this soil that have a surface layer of sand. Also included are areas where sandstone is at a depth of about 60 inches.

Runoff is medium, and the erosion hazard is moderate. This soil is subject to soil blowing. Low available water capacity limits crop yields during most seasons. It is better to plant early in spring before the soil has a chance to dry out than to plant later. Management practices are needed to supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Some areas of this soil are used for crops, but a fairly large part of the acreage is in native hardwood or conifer forests or has been planted to pine trees. This soil is not well suited to cultivated crops. It is suited to pasture and pine trees. Some areas are used for homesites. In places the loamy layer in the substratum restricts movement of sewage effluent from septic tank absorption fields. This soil has slight or moderate limitations for many nonfarm uses. Capability unit IVs–3; woodland suitability group 3o1; wildlife group 3; recreation group 4.

Riverwash

Re—Riverwash (0 to 2 percent slopes). This nearly level land type is along major streams. It consists of stream deposited sand and gravel. Most areas are long and narrow and range from 4 to 20 acres in size. Because these areas undergo frequent shifting and changing during flooding and stream channel changes, they support little or no natural vegetation.

Included with this land type in mapping are small areas of Alluvial land, sandy.

This land type is subject to frequent flooding. Depth to the water table ranges from a few inches beneath the surface to several feet, depending upon water levels of the nearby stream. Permeability is rapid. Available water capacity is very low, and natural fertility is low.

Because of flooding, droughtiness, and low fertility, this land type supports little or no vegetation. It is better suited to selected recreational uses than to other types of uses. In places it is a source of sand and gravel for commercial uses. It has severe limitations for most nonfarm uses. Capability unit VIIIs–10; woodland suitability group 6s1; wildlife group 10; recreation group 7.

Seaton Series

The Seaton series consists of well drained, nearly level to steep silty soils on ridges, in valleys, and on stream terraces. These soils formed in thick silt loam deposits. Native vegetation is hardwood trees.

In a representative profile the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 32 inches thick. It is yellowish brown silt loam in the upper part, dark yellowish brown heavy silt loam in the middle, and yellowish brown silt loam in the lower part. The substratum to a depth of about 60 inches is yellowish brown silt loam.

Permeability is moderate in these soils. Available water capacity is very high, and natural fertility is high.

Most areas of these soils are used for crops. A few small areas and areas of steep soils remain in woods. Areas of gently sloping soils are well suited to farming. Areas of sloping soils are moderately well suited to cultivated crops, but areas of moderately steep soils are not well suited to this use. Limitations for most nonfarm uses are slight or moderate in areas of less sloping soils.

Representative profile of Seaton silt loam, 6 to 12 percent slopes, eroded, in a cultivated field, 500 feet south and 300 feet east of the northwest corner of sec. 10, T. 26 N., R. 8 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

B1—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

B2t—12 to 34 inches; dark yellowish brown (10YR 4/4) heavy silt loam; moderate medium subangular blocky structure; firm; thin discontinuous clay films; strongly acid; clear smooth boundary.

B3—34 to 40 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; friable; strongly acid; gradual smooth boundary.

C—40 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; strongly acid.

Thickness of the solum ranges from 40 to 48 inches. The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2) and is 6 to 8 inches thick. In some profiles there is a thin, brown (10YR 5/3), platy A2 horizon. The B horizon is yellowish brown (10YR 5/4) or dark yellowish brown (10YR 4/4).

Seaton soils in this county are more acid in the lower part of the subsoil and in the substratum than is defined for the range of the series, but this difference does not alter their usefulness or behavior.

Seaton soils formed in material similar to that in which Gale, Mt. Carroll, Norden, and Otterholt soils formed. Seaton soils have a thicker solum than Gale and Norden soils. They formed in thick, silty deposits, while Gale and Norden soils formed in silty material and residuum from sandstone bedrock, which is at a depth of 20 to 40 inches. Seaton soils have a lighter colored A horizon than Mt. Carroll soils. Unlike Otterholt soils, Seaton soils do not have tongues of A2 material extending into an A&B horizon.

SeB—Seaton silt loam, 2 to 6 percent slopes. This gently sloping soil is on moderately broad ridgetops. Most areas are irregularly shaped and range from 20 to 100 acres in size.

Included with this soil in mapping are small areas of sloping Seaton soils. Also included are small areas of Seaton soils that have a surface layer of sandy loam. These areas are indicated by sand spot symbols on the soil map.

Runoff is medium, and the erosion hazard is slight or moderate. Management practices are needed to maintain organic matter content, improve tilth, reduce runoff, and control erosion.

Nearly all areas of this soil are used for crops. This soil is well suited to all crops commonly grown in the county. It is also suited to pasture, woodland, and wildlife habitat. It has slight or moderate limitations for most nonfarm uses. Capability unit IIe–1; woodland suitability group 1o1; wildlife group 1; recreation group 1.

SeC2—Seaton silt loam, 6 to 12 percent slopes, eroded. This sloping soil is on moderately broad ridgetops and sides of ridges. Most areas are oblong or irregularly shaped and range from 20 to 100 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Gale soils and small areas of severely eroded Seaton soils. Also included are small areas of Seaton soils that have a surface layer of sandy loam and, in places, sandy loam in the upper part of the subsoil. Areas where the surface layer is sandy loam are indicated by sand spot symbols on the soil map.

Runoff is medium, and the erosion hazard is moderate. Management practices are needed to maintain organic matter content, improve tilth, reduce runoff, and control erosion.

Most areas of this soil are used for crops. This soil is moderately well suited to all crops commonly grown in the county. It is suited to pasture, woodland, and wildlife habitat. It has slight or moderate limitations for most nonfarm uses. Capability unit IIIe–1; woodland suitability group 1o1; wildlife group 1; recreation group 1.

SeD2—Seaton silt loam, 12 to 20 percent slopes, eroded. This moderately steep soil is on ridges and hillsides. Most areas are oblong or irregularly shaped and range from 15 to 75 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is slightly thinner.

Included with this soil in mapping are small areas of Gale soils and areas of severely eroded Seaton soils. Also included are small areas of Seaton soils that have a surface layer of sandy loam. These areas are indicated by sand spot symbols on the soil map.

Runoff is rapid, and the erosion hazard is severe. Management practices are needed to reduce runoff, control erosion, maintain organic matter content, and improve tilth.

Most areas of this soil are used for crops. This soil is not well suited to cultivated crops. In many areas hay makes up the major part of the cropping sequence. This soil is suited to pasture, woodland, and wildlife habitat. It has moderate or severe limitations for most nonfarm uses. Capability unit IVe–1; woodland suitability group 1r1; wildlife group 1; recreation group 1.

SeE2—Seaton silt loam, 20 to 30 percent slopes, eroded. This steep soil is on hillsides and ridges. Most areas are long and narrow and range from 10 to 60 acres in size. The profile of this soil is similar to the one described as representative for the series, but the surface layer is slightly thinner and lighter colored.

Included with this soil in mapping are small areas of Gale and Northfield soils. Also included are areas of severely eroded Seaton soils, areas where slopes are more than 30 percent, and areas where the surface layer is sandy loam. Areas where the surface layer is sandy loam are indicated by sand spot symbols on the soil map.

Runoff is very rapid, and the erosion hazard is very severe. Management practices are needed to maintain plant cover, control erosion, and reduce runoff.

Because of the steep slopes, most areas of this soil are maintained in grass or trees. Many areas are in renovated pasture. This soil is generally unsuited to cultivated crops, but it can be used for pasture, woodland, and wildlife habitat. If grazing is controlled and proper renovation practices are used, this soil is highly productive for pasture. It has severe limitations for most nonfarm uses. Capability unit VIe–1; woodland suitability group 1r1; wildlife group 1; recreation group 1.

SfB—Seaton silt loam, benches, 2 to 6 percent slopes. This gently sloping soil is on broad stream terraces. Most areas are irregularly shaped and range from 20 to 100 acres in size. This soil is similar to the one described as representative for the series, but it is underlain by sand at a depth of 5 to 7 feet.

Included with this soil in mapping are small areas of Mt. Carroll, benches, and Seaton, moderately well drained, soils. Also included are areas of this soil that are underlain by sand at a depth as shallow as 40 inches.

Runoff is medium, and the erosion hazard is slight or moderate. Management practices are needed to maintain organic matter content, improve tilth, reduce runoff, and control erosion.

Nearly all areas of this soil are used for crops. This soil is highly productive and is well suited to all crops commonly grown in the county, including specialty crops. This soil is also suited to pasture, woodland, and wildlife habitat. It has slight limitations for most nonfarm uses. Capability unit IIe–1; woodland suitability group 1o1; wildlife group 1; recreation group 1.

SmA—Seaton silt loam, moderately well drained, 0 to 2 percent slopes. This nearly level soil is on broad stream terraces. Most areas are irregularly shaped and range from 20 to 100 acres in size. This soil has a profile similar to the one described as representative for the series, but it has mottles in the lower part of the subsoil.

Included with this soil in mapping are small areas of Curran soils. Also included are small areas of Seaton silt loam, benches.

Runoff is slow, and the erosion hazard is slight. Some areas of this soil dry out slowly in spring, and these areas are generally tilled about a week later than nearby well drained soils. Management practices are needed to supply regular additions of organic matter and improve tilth.

Most areas of this soil are used for crops. This soil is well suited to all crops commonly grown in the county. If properly managed, it is highly productive. It can be cropped intensively and has few limitations. This soil is slightly more productive than other Seaton soils, especially during years of low rainfall. It is well suited to pasture, woodland, and wildlife habitat. Because of restricted drainage in the lower part of the subsoil, this soil is less suited to urban developments and onsite sewage disposal systems than other Seaton soils. It has slight or moderate limitations for most nonfarm uses. Capability unit I–1; woodland suitability group 1o1; wildlife group 1; recreation group 1.

SmB—Seaton silt loam, moderately well drained, 2 to 6 percent slopes. This gently sloping soil is on broad stream terraces. Slopes are typically long and gentle. Most areas are irregularly shaped and range from 10 to 80 acres in size. This soil has a profile similar to the one described as representative for the series, but it has mottles in the lower part of the subsoil. Included in mapping are small areas of Seaton silt loam, benches.

Runoff is slow or medium, and the erosion hazard is slight or moderate. Management practices are needed to maintain organic matter content, improve tilth, reduce runoff, and control erosion.

Most areas of this soil are used for crops. This soil is well suited to all crops commonly grown in the county. It is slightly more productive than other Seaton soils, especially during years of low rainfall. This soil is also suited to woodland, pasture, and wildlife habitat. Because of restricted drainage in the lower part of the subsoil, this soil is less suited to urban developments and onsite sewage disposal systems than other Seaton soils. It has slight or moderate limitations for most nonfarm uses. Capability unit IIe–1; woodland suitability group 1o1; wildlife group 1; recreation group 1.

Shiffer Series

The Shiffer series consists of somewhat poorly drained, nearly level, loamy soils that are underlain by sand. These soils are on stream terraces and outwash plains. Native vegetation is scattered hardwood trees and prairie grasses.

In a representative profile the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is dark brown and brown, mottled loam about 22 inches thick. The substratum to a depth of about 60 inches is light yellowish brown, mottled fine and medium sand.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderate. In undrained areas these soils are saturated at a depth of 1 to 3 feet during wet periods. In places they are ponded for short periods in spring or following heavy rainfall.

Most areas of these soils are farmed. A few areas are in woods or pasture or are used for wildlife habitat. Shiffer soils are suited to farming if excess water is removed. They are also suited to wildlife habitat and woodland. Limitations for nonfarm uses are moderate or severe.

Representative profile of Shiffer loam that has 0 to 2 percent slopes, in a cultivated field, 700 feet north and 300 feet west of the southeast corner of the NE¼ sec. 6, T. 27 N., R. 10 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) when dry; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

B1—8 to 14 inches; dark brown (10YR 4/3) loam; common medium faint dark yellowish brown (10YR 4/4) mottles and few fine faint grayish brown (10YR 5/2) mottles; weak thick platy structure parting to weak fine subangular blocky; friable; neutral; clear smooth boundary.

B2t—14 to 26 inches; brown (10YR 5/3) loam; common medium faint dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin patchy clay films; higher clay content than the B1 and B3 horizon; medium acid; clear smooth boundary.

B3—26 to 30 inches; brown (10YR 5/3) loam; common medium faint dark brown (7.5YR 4/4) and brown (7.5YR 5/4) mottles, common medium prominent strong brown (7.5YR 5/8) and distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; friable; strongly acid; clear smooth boundary.

IIC—30 to 60 inches; light yellowish brown (10YR 6/4) fine and medium sand; many medium distinct dark brown (7.5YR 4/4) and grayish brown (10YR 5/2) mottles; single grained; loose; strongly acid.

Thickness of the solum ranges from 20 to 40 inches. The Ap horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1). In places the B3 horizon is sandy loam.

Shiffer soils are near Dells, Lows, and Meridian, moderately well drained, soils. Shiffer soils have drainage similar to that of Dells soils, but they lack the silt loam texture of those soils. Shiffer soils are somewhat poorly drained, and Lows soils are poorly drained.

So—Shiffer loam (0 to 2 percent slopes). This nearly level soil is on broad stream terraces. Most areas are irregularly shaped and range from 10 to 100 acres in size.

Included with this soil in mapping are small areas of Lows soils; small areas of Meridian, moderately well drained, soils; and small areas where the soil is similar to this one except that it has a surface layer of sandy loam. Also included are areas where the soil has loam or silt loam layers ½ inch to 12 inches thick at a depth of 36 to 60 inches. These layers are underlain by medium sand.

Runoff is slow and, in places, this soil is ponded for short periods in spring or following heavy rainfall. The erosion hazard is slight. Open ditches or surface drains are needed for dependable crop production. If the water table is lowered excessively, this soil is somewhat droughty. Management practices are needed to control drainage, maintain organic matter content, and improve tilth.

Most areas of this soil are used for crops. A few areas are used for woodland or wildlife habitat. If adequately drained, this soil is suited to all crops commonly grown in the county. It is also suited to pas-

ture, woodland, and wildlife habitat. It has moderate or severe limitations for most nonfarm uses. Capability unit IIw–5; woodland suitability group 3o2; wildlife group 6; recreation group 5.

Sparta Series

The Sparta series consists of excessively drained, nearly level and gently sloping, dark colored, sandy soils on stream terraces and outwash plains. Native vegetation is prairie vegetation, mainly tall grasses.

In a representative profile the surface layer is loamy sand about 18 inches thick. It is very dark brown in the upper part and very dark grayish brown in the lower part. The subsoil is about 14 inches thick. It is dark brown loamy sand in the upper part and brown medium sand in the lower part. The substratum to a depth of about 60 inches is brownish yellow medium sand.

Available water capacity and natural fertility are low in these soils. Permeability is very rapid.

Most areas of these soils are farmed. Some areas are in pine plantations, and others have been used for urban development. These soils are not well suited to farming, and crop response is low unless these soils are irrigated. They are suited to such trees as red pine that require little water. Limitations for most nonfarm uses are slight or moderate.

Representative profile of Sparta loamy sand, 1 to 6 percent slopes, in a cultivated field, 1,250 feet east and 30 feet south of the center of the SE¼ sec. 30, T. 27 N., R. 10 W.:

Ap—0 to 10 inches; very dark brown (10YR 2/2) loamy sand; weak medium subangular blocky structure; very friable; medium acid; abrupt smooth boundary.

A12—10 to 18 inches; very dark grayish brown (10YR 3/2) loamy sand; weak medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

B2—18 to 24 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

B3—24 to 32 inches; brown (7.5YR 5/4) medium sand; single grained; loose; medium acid; gradual smooth boundary.

C—32 to 60 inches; brownish yellow (10YR 6/6) medium sand; single grained; loose; medium acid.

Thickness of the solum ranges from 24 to 40 inches. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), and very dark grayish brown (10YR 3/2). It ranges from 10 to 20 inches in thickness.

In most areas these soils contain more medium and coarse sand than those soils within the defined range for the series, but this difference does not alter their usefulness and behavior.

Sparta soils are near Burkhardt, Gotham, and Trempe soils. Sparta soils are coarser textured than Burkhardt soils and, unlike those soils, lack gravel in the lower part. Sparta soils have a thicker and darker colored A horizon than Gotham soils, and they lack the horizon of clay accumulation that is in Gotham soils. Sparta soils lack the reddish hue of Trempe soils.

SpB—Sparta loamy sand, 1 to 6 percent slopes. This nearly level and gently sloping soil is on outwash plains and stream terraces. Most areas are irregularly shaped and range from 25 to 125 acres in size.

Included with this soil in mapping are areas where the surface layer is thinner than that described as representative for the series. Also included are areas of Sparta soils that have slopes of as much as 10 percent.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Low available water capacity limits crop growth during most seasons. It is better to plant early in spring before the soil has a chance to dry out than to plant later. Management practices are needed to maintain organic matter content, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most areas of this soil are used for crops, but some areas are in pine plantations. This soil is not well suited to most crops commonly grown in the county. It is suited to irrigation and can be more intensively cropped if properly irrigated and managed. This soil is suited to pasture, pine trees, and some kinds of wildlife habitat. It has slight or moderate limitations for most nonfarm uses. Capability unit IVs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

Tell Series

The Tell series consists of well drained, nearly level and gently sloping, silty soils that are underlain by sand. These soils are on stream terraces and outwash plains. Native vegetation is hardwood trees.

In a representative profile the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 2 inches thick. The subsoil is about 24 inches thick. It is yellowish brown silt loam in the upper part, dark yellowish brown heavy silt loam in the middle, and dark brown loam in the lower part. The substratum to a depth of about 60 inches is yellowish brown sand.

Available water capacity is moderate in these soils, and natural fertility is medium or high. Permeability is moderate.

Most areas of these soils are farmed. A few small areas are in woods. These soils are well suited to farming. They are also suited to woodland or wildlife habitat. Limitations for nonfarm uses are slight or moderate.

Representative profile of Tell silt loam, 2 to 6 percent slopes, in a cultivated field, 350 feet north and 1,150 feet east of the southwest corner of sec. 9, T. 26 N., R. 7 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

A2—8 to 10 inches; brown (10YR 5/3) silt loam; weak thin platy structure; friable; neutral; clear smooth boundary.

B1—10 to 14 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

B2t—14 to 30 inches; dark yellowish brown (10YR 4/4) heavy silt loam; moderate medium subangular blocky structure; firm; thin continuous clay films on ped faces; strongly acid; clear smooth boundary.

IIB3t—30 to 34 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; thin patchy clay films; strongly acid; clear smooth boundary.

IIC—34 to 60 inches; yellowish brown (10YR 5/4) medium and fine sand; single grained; loose; medium acid.

Thickness of the solum ranges from 20 to 40 inches, nearly the same as the thickness of the silty and loamy material over sand. The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). In places the A2 horizon is lacking because of plow mixing, and in places the IIB3t horizon is sandy loam.

Tell soils are near Meridian, Pillot, and Seaton, benches, soils. Tell soils are finer textured than Meridian soils. They lack the thick, dark colored A horizon of Pillot soils. Tell soils are shallower to sand than Seaton, benches, soil.

TeA—Tell silt loam, 0 to 2 percent slopes. This nearly level soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 8 to 50 acres in size. This soil has a profile similar to the one described as representative for the series, but it is slightly deeper to underlying sand. Included in mapping are areas of Meridian soils.

Runoff is slow, and the erosion hazard is slight. Moderate available water capacity limits growth of crops during many seasons. Management practices are needed to maintain organic matter content, improve tilth, and conserve moisture.

Nearly all areas of this soil are used for crops. This soil is well suited to all crops commonly grown in the county. It is also suited to pasture, woodland, and wildlife habitat. This soil has slight or moderate limitations for most nonfarm uses. Capability unit IIs–1; woodland suitability group 2o1; wildlife group 1; recreation group 1.

TeB—Tell silt loam, 2 to 6 percent slopes. This gently sloping soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 5 to 40 acres in size. This soil has the profile described as representative for the series. Included in mapping are small areas of Meridian soils.

Runoff is medium, and the erosion hazard is slight or moderate. Management practices are needed to maintain organic matter content, improve tilth, reduce runoff, and control erosion.

Most areas of this soil are used for crops. This soil is well suited to all crops commonly grown in the county. It is also suited to pasture, woodland, and wildlife habitat. This soil has slight or moderate limitations for most nonfarm uses. Capability unit IIe–2; woodland suitability group 2o1; wildlife group 1; recreation group 1.

Terrace Escarpments

Tn—Terrace escarpments, sandy. This land type consists of moderately steep to very steep sandy escarpments along the edges of stream terraces. Most areas are long and narrow and range from 10 to 90 acres in size.

Included with this land type in mapping are small areas of steep Plainfield, Sparta, Trempe, and Gotham soils. Also included are small areas where the texture is dominantly sandy loam, loam, or silt loam. Areas too narrow to separate on the soil map are indicated by escarpment symbols.

Available water capacity and natural fertility are low. Permeability is rapid. Runoff is rapid, and the erosion hazard is severe. These escarpments are subject to soil blowing. Management practices are needed to maintain plant cover, conserve moisture, and control erosion and soil blowing.

This land type is unsuited to farming. It needs a cover of permanent vegetation to prevent erosion. Trees that require little water, such as red pine, grow in areas of this land type, but they are difficult to manage because of the steep slopes. This land type is suited to some types of upland wildlife habitat. It has severe limitations for nonfarm uses. Capability unit VIIs–9; woodland suitability group 4s2; wildlife group 3; recreation group 4.

Trempe Series

The Trempe series consists of excessively drained, nearly level and gently sloping, sandy soils on stream terraces and outwash plains. Native vegetation is prairie grasses.

In a representative profile the surface layer is about 16 inches thick. It is dark brown loamy sand in the upper 9 inches and dark reddish brown loamy sand in the lower 7 inches. The substratum to a depth of about 60 inches is reddish brown and yellowish brown sand.

Available water capacity and natural fertility are low in these soils. Permeability is rapid.

Most areas of these soils are used for crops. Some areas have been planted to pines. These soils are not well suited to farming, and crop response is low where the soils are not irrigated. They are suited to some types of open land wildlife habitat and to plants, such as pine trees, that require little water. Limitations for many nonfarm uses are slight or moderate.

Representative profile of Trempe loamy sand, 1 to 6 percent slopes, in a cultivated field, 200 feet south and 100 feet east of the northwest corner of the NE¼ sec. 16, T. 26 N., R. 10 W.:

Ap—0 to 9 inches; dark brown (7.5YR 3/2) loamy sand; weak medium subangular blocky structure; very friable; strongly acid; abrupt smooth boundary.

A12—9 to 16 inches; dark reddish brown (5YR 3/3) loamy sand; weak medium subangular blocky structure; very friable; medium acid; gradual smooth boundary.

C1—16 to 26 inches; reddish brown (5YR 4/4) medium sand; single grained; loose; slightly acid; gradual smooth boundary.

C2—26 to 60 inches yellowish brown (10YR 5/4) medium and coarse sand single grained; loose; slightly acid.

The Ap or A1 horizon is dark brown (7.5YR 3/2), very dark brown (10YR 2/2), or dark reddish brown (5YR 2/2). The C horizon has thin strata of fine gravel in places.

Trempe soils are near Dunnville, Plainfield, and Sparta soils. Trempe soils are coarser textured than Dunnville soils. They formed in material similar to that in which Plainfield soils formed, but they have a thicker and darker colored A horizon than those soils. Trempe soils have a redder hue than Sparta soils.

TrB—Trempe loamy sand, 1 to 6 percent slopes. This nearly level and gently sloping soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 10 to 45 acres in size. Included in mapping are small areas of Dunnville and Sparta soils.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Low available

water capacity limits crop yields during most seasons. It is better to plant early in spring before the soil has a chance to dry out than to plant later. Management practices are needed to supply regular additions of organic matter, conserve moisture, reduce runoff, and control erosion and soil blowing.

Most areas of this soil are used for crops. A few areas have been planted to pine trees. This soil is not well suited to most crops commonly grown in the county. It is suited to irrigation and can be more intensively cropped if properly irrigated and managed. This soil is suited to pasture, pine trees, and some kinds of wildlife habitat. It has slight or moderate limitations for many nonfarm uses. Capability unit IVs–3; woodland suitability group 3s1; wildlife group 3; recreation group 4.

Urne Series

The Urne series consists of somewhat excessively drained, moderately steep to very steep, loamy soils on narrow tops and sides of ridges on sandstone uplands. Native vegetation is hardwood trees.

In a representative profile the surface layer is dark grayish brown very fine sandy loam about 6 inches thick. The subsoil is olive very fine sandy loam about 18 inches thick. The substratum to a depth of about 60 inches is olive and greenish gray, weakly cemented glauconitic sandstone.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderate.

A few areas of these soils are used for crops. In most areas, however, the soils are too steep for crops and are in woodland, pasture, or wildlife habitat. Limitations for most nonfarm uses are severe.

Representative profile of Urne very fine sandy loam, 20 to 45 percent slopes, in a cultivated field, 600 feet west and 200 feet north of the southeast corner of sec. 28, T. 29 N., R. 9 W.:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) very fine sandy loam; weak very fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

B2—6 to 24 inches; olive (5Y 4/4) very fine sandy loam; weak medium subangular blocky structure; friable; medium acid; clear smooth boundary.

C—24 to 60 inches; olive (5Y 4/4) and greenish gray (5G 5/1) platy weakly cemented glauconitic sandstone; slightly acid.

Thickness of the solum and depth to glauconitic sandstone ranges from 20 to 40 inches. The Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). It is 6 to 8 inches thick. In uncultivated areas there is an A1 horizon that is 2 to 4 inches thick. It is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). The B horizon is sandy loam or very fine sandy loam. The underlying sandstone is dominantly weakly cemented, but in places it has strongly indurated layers.

Urne soils are near Elkmound, Norden, and Northfield soils. Urne soils are underlain by glauconitic sandstone, and Elkmound and Northfield soils are underlain by sandstone that is not glauconitic. Urne soils have less silt and clay in the A and B horizons than Norden soils.

UnD2—Urne very fine sandy loam, 12 to 20 percent slopes, eroded. This moderately steep soil is on the sides of ridges. Most areas are long and narrow and range from 10 to 50 acres in size. This soil has a profile similar to the one described as representative for the series, but it is slightly deeper to sandstone.

Included with this soil in mapping are small areas of Elkmound soils. Also included are areas of severely eroded Urne soils.

Runoff is rapid, and the erosion hazard is severe. Management practices are needed to maintain organic matter content, conserve moisture, reduce runoff, and control erosion.

Less than half of the acreage of this soil is used for crops. The rest is in pasture, woodland, or wildlife habitat. This soil is not well suited to cultivated crops but is suited to pasture, forage crops, or woodland. It has severe limitations for most nonfarm uses. Capability unit IVe–2; woodland suitability group 3r1; wildlife group 1; recreation group 1.

UnE—Urne very fine sandy loam, 20 to 45 percent slopes. This steep and very steep soil is on the sides of ridges. Most areas are long and narrow. They range from 15 to 100 acres in size. This soil has the profile described as representative for the series. Included in mapping are small areas of Elkmound soils.

Runoff is very rapid, and the erosion hazard is very severe. Management practices are needed to maintain plant cover and control erosion.

Most areas of this soil are in hay, pasture, or trees. Some areas are used for wildlife habitat. A few small areas are used for crops. This soil is unsuited to farming. It is used for pasture, woodland, or wildlife habitat. It has severe limitations for nonfarm uses. Capability unit VIIe–2; woodland suitability group 3r1; wildlife group 1; recreation group 1.

Veedum Series

The Veedum series consists of very poorly drained, nearly level loamy soils in depressions and along drainageways on sandstone uplands. These soils formed partly in residuum weathered from interbedded sandstone and shale. Native vegetation is grasses, sedges, and shrubs that require large amounts of water.

In a representative profile the surface layer is black silt loam about 12 inches thick. The subsurface layer is gray, mottled sandy loam about 5 inches thick. The subsoil is about 15 inches thick. It is gray loam in the upper part and dark gray silt loam in the lower part. The substratum to a depth of about 60 inches is gray sand in the upper 6 inches and very pale brown and gray stratified soft sandstone and sandy shale below.

Permeability is moderately slow. Available water capacity is moderate, and natural fertility is medium. In undrained areas ground water is at or near the surface throughout the year.

Most areas of these soils remain in grass and low brushy vegetation. Some areas are drained and used for pasture and crops. These soils are not well suited to farming. They are well suited to wetland wildlife habitat. Limitations for most nonfarm uses are moderate or severe.

Representative profile of Veedum silt loam that has 0 to 2 percent slopes, in an uncultivated field, 950 feet north and 400 feet east of the southwest corner of the NW¼ sec. 36 T. 25 N., R. 5 W.:

A1—0 to 12 inches; black (10YR 2/1) silt loam; weak medium granular structure; friable; strongly acid; clear smooth boundary.

A2g—12 to 17 inches; gray (10YR 5/1) sandy loam; many coarse prominent dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; very strongly acid; clear smooth boundary.

IIB2g—17 to 28 inches; gray (5Y 5/1) loam; weak medium subangular blocky structure; friable; very strongly acid; clear smooth boundary.

IIIB3g—28 to 32 inches; dark gray (10YR 4/1) silt loam; weak coarse subangular blocky structure; firm; strongly acid; clear smooth boundary.

IVC1g—32 to 38 inches; gray (5Y 6/1) sand; single grained; loose; very strongly acid; clear smooth boundary.

IVC2g—38 to 60 inches; stratified very pale brown (10YR 7/3) medium grained soft sandstone and gray (N 5/0) soft sandy shale; friable; very strongly acid.

Thickness of the solum ranges from 24 to 40 inches. The A1 horizon is black (10YR 2/1) or very dark gray (10YR 3/1) and is 10 to 20 inches thick. It commonly is silt loam, but in a few areas it is loam or is covered by a thin organic layer. The A2g horizon is silt loam, loam, sandy loam, or loamy sand and is 5 to 10 inches thick. It is gray (10YR 5/1) or olive gray (5Y 5/1) and is mottled. The B2g horizon is loam or clay loam and ranges from 8 to 12 inches in thickness. The B3g horizon is silt loam, loam, or sandy loam and ranges from 4 to 6 inches in thickness. The C horizon has strata of sandy, loamy, or clayey residuum weathered from sandstone and shale.

Veedum soils formed in material similar to that in which Vesper soils formed. Veedum soils have a thicker A1 horizon than the one in Vesper soils.

Vd—Veedum silt loam (0 to 2 percent slopes). This nearly level soil is in broad depressions on sandstone uplands. Most areas are irregularly shaped and range from 10 to 160 acres in size.

Included with this soil in mapping are small areas of Elm Lake and Markey soils. Also included are areas of this soil that have slopes of as much as 10 percent.

Runoff is very slow, and the erosion hazard is slight. This soil receives runoff from adjoining areas and is commonly ponded during wet seasons and after heavy rains. Surface drainage removes excess water rapidly. Deep ditches or tile drains are used for internal drainage. Crops grown on this soil are subject to frost damage. Management practices are needed to remove excess water and maintain good tilth.

Most areas of this soil remain in woods. Some areas are used for pasture and crops. Even if excess water is removed and tilth is maintained, this soil is not well suited to farming. It is suited to pasture and wetland wildlife habitat. This soil has moderate or severe limitations for most nonfarm uses. Capability unit IVw–3; woodland suitability group 5w5; wildlife group 7; recreation group 6.

Vesper Series

The Vesper series consists of poorly drained, nearly level loamy soils in depressions on sandstone uplands. These soils formed partly in residuum weathered from interbedded sandstone and shale. Native vegetation is mainly elm, soft maple, aspen, and ash.

In a representative profile the surface layer is very dark gray loam about 8 inches thick. The subsurface layer is grayish brown, mottled loam about 9 inches thick. The subsoil is gray, mottled loam about 16 inches thick. The substratum is gray sand in the upper 6 inches and gray weathered sandstone that contains thin grayish green silty clay layers between depths of 6 and 60 inches.

Available water capacity is moderate in these soils, and natural fertility is medium. Permeability is moderately slow. In undrained areas ground water is at or near the surface throughout the year.

Most areas of these soils are in native trees and used for wildlife habitat. Some small areas are used for crops. Vesper soils are moderately well suited to farming if excess water is removed. Limitations for many nonfarm uses are severe.

Representative profile of Vesper loam that has 0 to 2 percent slopes, in a cultivated field, 1,200 feet north and 850 feet east of the southwest corner of the NW¼ sec. 34, T. 25 N., R. 5 W.:

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) when dry; weak fine and very fine subangular blocky structure; friable; less than 5 percent coarse fragments; medium acid; abrupt smooth boundary.

A2—8 to 17 inches; grayish brown (10YR 5/2) loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak thin platy structure; friable; strongly acid; clear wavy boundary.

B21g—17 to 26 inches; gray (5Y 5/1) loam; common medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/8) mottles; weak moderate subangular blocky structure; firm; strongly acid; clear smooth boundary.

B22g—26 to 33 inches; gray (5Y 5/1) heavy loam; many coarse prominent dark brown (7.5YR 4/4), strong brown (7.5YR 5/8), and olive brown (2.5Y 4/4) mottles; weak moderate subangular blocky structure; firm; strongly acid; clear smooth boundary.

IIC1g—33 to 39 inches; gray (10YR 6/1) sand; single grained; loose; very strongly acid; clear smooth boundary.

IIC2g—39 to 60 inches; gray (10YR 6/1) weathered sandstone; single grained; loose; 4 inch band of greenish gray (5GY 5/1) silty clay shale near lower boundary; very strongly acid.

Thickness of the solum ranges from 24 to 40 inches. The A horizon is black (10YR 2/1), very dark grayish brown (10YR 3/2), or very dark gray (10YR 3/1). The B21g horizon ranges in thickness from 6 to 10 inches. The B22g horizon ranges in thickness from 5 to 8 inches. Thickness and arrangement of sandy and clayey horizons in the weathered sandstone and shale residuum vary greatly.

Vesper soils formed in material similar to that in which Kert and Veedum soils formed. Vesper soils are poorly drained, Kert soils are somewhat poorly drained, and Veedum soils are poorly drained.

Ve—Vesper loam (0 to 2 percent slopes). This nearly level soil is in broad depressions on sandstone uplands. Most areas are long and narrow and range from 5 to 50 acres in size.

Included with this soil in mapping are small areas of Kert soils. Also included are areas of this soil that have a subsurface layer of sandy loam.

Runoff is very slow, and the erosion hazard is slight. This soil receives runoff from adjoining areas

and is commonly ponded during wet seasons and after heavy rains. Surface drainage removes excess water rapidly. Deep ditches or tile drains are used for internal drainage. Crops grown on this soil are subject to frost damage. Management practices are needed to remove excess water and maintain good tilth.

Most areas of this soil are in woods. Some areas are used for crops. If excess water is removed, this soil is moderately well suited to farming. It is also suited to pasture, woodland, and wildlife habitat. This soil has severe limitations for most nonfarm uses. Capability unit IIIw–3; woodland suitability group 5w5; wildlife group 7; recreation group 6.

Vilas Series

The Vilas series consists of excessively drained, nearly level and gently sloping sandy soils on stream terraces and outwash plains. Native vegetation is pine and hardwood trees.

In a representative profile the surface layer is very dark gray sand about 1 inch thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is sand about 21 inches thick. It is dark reddish brown in the upper part, dark brown in the middle, and brown in the lower part. The substratum to a depth of about 60 inches is light brown sand.

Available water capacity is very low in these soils, and natural fertility is low. Permeability is very rapid.

Some areas of these soils are in woods and support pine and scrub oak. Vilas soils are not suited to farming. They are suited to such trees as red pine and jack pine. Limitations for many nonfarm uses are slight or moderate.

Representative profile of Vilas sand, 1 to 6 percent slopes, in a wooded area, 550 feet north and 550 feet east of the southwest corner of the SE¼ sec. 2, T. 27 N., R. 5 W.:

A1—0 to 1 inch; very dark gray (10YR 3/1) medium and fine sand; light gray (10YR 7/1) sand grains in places; weak fine granular structure; very friable; strongly acid; abrupt smooth boundary.

A2—1 inch to 3 inches; brown (7.5YR 5/2) medium and fine sand; single grained; loose; very strongly acid; abrupt smooth boundary.

B2hir—3 to 7 inches; dark reddish brown (5YR 3/4) medium and fine sand; weak coherent bodies; loose when disturbed; very strongly acid; clear smooth boundary.

B2ir—7 to 16 inches; dark brown (7.5YR 4/4) medium and fine sand; slightly coherent bodies; loose when disturbed; strongly acid; clear smooth boundary.

B3—16 to 24 inches; brown (7.5YR 5/4) medium and fine sand; single grained; loose; medium acid; clear smooth boundary.

C—24 to 60 inches; light brown (7.5YR 6/4) medium and fine sand; single grained; loose; medium acid.

Thickness of the solum ranges from 16 to 30 inches. The A1 horizon is very dark gray (10YR 3/1) or black (10YR 2/1). The B2 horizon is dark reddish brown (5YR 3/4) or dark brown (7.5YR 4/4). It ranges in thickness from 6 to 18 inches. In places the C horizon contains small amounts of coarse sand and fine gravel.

Vilas soils are near Menahga soils. Vilas soils have a dark reddish brown or dark brown B horizon in which iron and humus have accumulated. This horizon is lacking in Menahga soils.

VlB—Vilas sand, 1 to 6 percent slopes. This nearly level and gently sloping soil is on stream terraces and outwash plains. Most areas are irregularly shaped and range from 25 to 200 acres in size. The smaller areas are mainly elongated tracts parallel to streams in narrow valleys. Included in mapping are areas of moderately well drained Vilas soils.

Runoff is slow, and the erosion hazard is slight. This soil is subject to soil blowing. Management practices are needed to maintain plant cover and control erosion and soil blowing.

Most areas of this soil are in woods. A few small areas have been cleared and are used for crops or pasture. Unless irrigated, this soil is unsuited to farming. It is better suited to pine trees, such as jack pine and red pine. This soil has moderate limitations for most nonfarm uses. Capability unit VIIs–9; woodland suitability group 4s1; wildlife group 3; recreation group 4.

Whitehall Variant

The Whitehall variants consist of deep, well drained, nearly level silty soils on low stream terraces. Native vegetation is prairie grasses.

In a representative profile the surface layer is about 20 inches thick. It is very dark brown silt loam in the upper 14 inches and dark brown silt loam in the lower 6 inches. The subsoil is reddish brown heavy silt loam about 26 inches thick. The substratum to a depth of about 60 inches is reddish brown sandy loam in the upper 10 inches and dark brown fine and medium sand below.

Available water capacity and natural fertility are high in these soils. Permeability is moderate.

All but a few small areas of these soils are used for crops. These soils are well suited to farming. Limitations for many nonfarm uses are slight or moderate.

Representative profile of Whitehall silt loam, deep variant, that has 0 to 2 percent slopes, in a cultivated field, 400 feet north and 500 feet west of the center of sec. 9, T. 26 N., R. 10 W.:

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; weak medium granular structure; friable; slightly acid; clear smooth boundary.

A12—8 to 14 inches; very dark brown (10YR 2/2) silt loam; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

A13—14 to 20 inches; dark brown (7.5YR 3/2) silt loam; weak medium platy structure; friable; medium acid; gradual smooth boundary.

B1—20 to 24 inches; reddish brown (5YR 4/4) silt loam; weak fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

B21t—24 to 34 inches; reddish brown (5YR 4/4) heavy silt loam; moderate fine subangular blocky structure; firm; thin patchy clay films; strongly acid; clear smooth boundary.

B22t—34 to 46 inches; reddish brown (5YR 4/3) heavy silt loam; moderate medium subangular blocky structure; firm; thin patchy clay films and clay in ped pores; medium acid; clear smooth boundary.

IIC1—46 to 56 inches; reddish brown (5YR 4/3) sandy loam; massive; friable; medium acid; gradual smooth boundary.

IIC2—56 to 60 inches; dark brown (7.5YR 4/4) fine and medium sand; single grained; loose; slightly acid.

Thickness of the solum ranges from 40 to 48 inches. Thickness of the silty and loamy material ranges from 40

to 60 inches. The A1 horizon ranges in thickness from 10 to 20 inches and is very dark brown (10YR 2/2) or black (10YR 2/1). The A13 horizon, where present, is dark brown (7.5YR 3/2).

Whitehall variants are near Pillot soils. They have thicker combined A and B horizons and a redder hue than Pillot soils.

Wh—Whitehall silt loam, deep variant (0 to 2 percent slopes). This nearly level soil is on broad stream terraces. Most areas are irregularly shaped and range from 40 to 200 acres in size.

Runoff is slow. Management practices are needed to supply regular additions of organic matter and maintain good tilth.

Nearly all areas of this soil are used for crops. If properly managed, this soil has few limitations and can be cropped intensively. This soil is generally very productive. It is well suited to all crops commonly grown in the county, including specialty crops. It is also suited to pasture and wildlife habitat. Because of the thick, dark, friable surface layer and the close proximity to urban areas, many areas of this soil are being stripped of topsoil by commercial suppliers. This soil has slight or moderate limitations for most nonfarm uses. Capability unit I–1; not placed in a woodland suitability group; wildlife group 5; recreation group 1.

Use and Management of the Soils

This section contains information about the use and management of the soils of Eau Claire County for crops and pasture, woodland, wildlife habitat, recreation, and engineering. In it the system of capability classification used by the Soil Conservation Service is explained and the predicted yields of the principal crops grown in the county under a high level of management are given. Also, the soils are grouped according to their suitability for woodland and wildlife habitat and rated for farm and nonfarm uses and recreation.

Management for Crops and Pasture

According to the Wisconsin Statistical Reporting Service, the following were the crop yields in Eau Claire County in 1971: 23,300 acres of corn for grain, 6,500 acres of corn for silage, 39,500 acres of alfalfa hay, 11,300 acres of timothy and clover hay, 21,300 acres of oats, 1,500 acres of soybeans, 200 acres of barley, 200 acres of potatoes, 150 acres of wheat, and 100 acres of sweet corn. Local growers stated that in 1974 they planned to grow 1,875 acres of dried beans, 650 acres of peas, and 250 acres of horseradish. Data for other specialty crops is not available, but the acreage of such crops is small.

Cropland makes up about 106,825 acres, about 26 percent of Eau Claire County. Pasture makes up about 19,270 acres. The rest of the county is former cropland that is now idle or is in woodland, wildlife habitat, or urban and other nonfarm uses. Long term trends indicate that cropland acreage will remain stable or be slightly reduced, pasture acreage will be moderately reduced, and woodland acreage will remain stable. The above reductions will result mainly from an increase in urban or recreational uses. In the paragraphs that follow, basic practices are suggested for the commonly grown crops and for pasture.

The soils of Eau Claire County vary widely in their suitability for specific crops and in the management required. Maintaining tilth and fertility, liming, controlling erosion, providing drainage, and renovating pastures are basic practices that benefit most of the soils.

Minimum tillage, the use of grasses and legumes in the cropping system, and the addition of organic matter to the soil help to maintain or improve tilth. Excess tillage and the use of heavy farm machinery compact the soil material, especially if the soil is wet. Abundant organic matter is supplied through the use of crop residue and the application of barnyard manure.

The soils in any given field may differ in acidity. Deep soils, such as those of the Otterholt and Seaton series, generally need the heaviest applications of lime. Some of the less productive shallow soils, such as those of the Elkmound series, and sandy soils, such as those of the Gotham series, generally require low amounts of lime. Lime should be applied on the basis of soil tests.

Onsite tests should be made to determine the kinds and amounts of fertilizer needed for all soils. All crops grown in Eau Claire County generally respond well to applications of commercial fertilizer. Organic soils, such as those of the Adrian, Houghton, and Markey series, have a low content of phosphorus and potassium. Regular applications of these elements are needed for good crop growth.

Runoff has eroded large areas of Gale, Otterholt, Seaton, and other soils in Eau Claire County. Terracing, use of grassed waterways, stripcropping, contour tillage, plow planting, use of cover crops, and returning crop residue to the soil help to control water erosion. All of these practices are also effective in reducing runoff and increasing infiltration. A cropping sequence consisting mainly of close growing crops commonly controls erosion on the steeper soils. Contour stripcropping and terracing permit more intensive cropping on cultivated soils that are subject to water erosion. Grassed waterways are commonly used in areas that receive excess water after rainfall. Diversions direct water away from critical areas and reduce the length of slopes. They are also very effective in protecting low lying soils from runoff from higher areas. Terraces are commonly used to protect gently sloping and sloping soils, such as Fallcreek, Mt. Carroll, and Seaton. from water erosion. In general soils can be cropped more intensively after terraces have been installed.

Plainfield and Sparta soils and some of the other sandy soils are susceptible to soil blowing. Control of the soil blowing is commonly provided by wind stripcropping. shelterbelts, stubble mulching, returning crop residue on the surface, and using cover crops. Organic soils such as Adrian need protection from soil blowing if they are drained and cultivated.

Wet soils, such as those of the Curran, Ettrick, and Houghton series, make up about 102,000 acres of Eau Claire County. These wet soils receive runoff from adjacent areas and are saturated at a depth of less than 3 feet for significant periods. In some areas they have moderately rapid, moderate, or moderately slow permeability in the subsoil; and in other areas they have a fluctuating high water table or are periodically flooded by stream overflow. Many of these soils can be intensively cultivated if they are adequately drained or protected from overwash or flooding.

In places diversions can be used to protect these soils from runoff from adjacent areas. In other places ditches are needed to convey water to a natural waterway. Shallow ditches can be used where deep ditches and tile drains are difficult to maintain, such as in areas of Kert and Shiffer soils that have an unstable subsoil or substratum. In very poorly drained soils, such as those of the Ettrick and Houghton series, tile drains and deep open ditches are needed to provide adequate drainage. Arenzville and Orion soils are examples of soils that need protection from stream overflow.

Most forage in the county is obtained from hay grown in sequence with other crops. The hay is either cut green and fed to livestock, or it is allowed to dry. Most upland pastures on the well drained soils in capability classes II, III, IV, and VI need periodic renovation to maintain fertility. A good seedbed must be prepared, and a suitable mixture of grasses and legumes should be seeded. Alfalfa with bromegrass or clover with timothy are examples of suitable mixtures for seeding. A companion crop of oats provides protective cover the first year and thus helps in controlling erosion.

Large amounts of phosphorus and potassium are generally needed at the time of seeding. Nitrogen can be applied as a topdressing if the stand consists mostly of grasses. Permanent pasture should be topdressed yearly or renovated periodically to maintain good quality forage. On steep or sandy soils, controlled grazing is needed to maintain good sod that helps control erosion.

Land types in capability class V such as Alluvial land, wet, are subject to frequent flooding or ponding of long duration and have a high water table. They are not suited to tillage, and renovation is not feasible. Such soils are generally kept in meadow and should only be grazed in dry seasons.

Pasture on soils in capability class VI is more difficult to renovate than it is on soils in capability classes II, III, and IV. Controlled grazing is needed. Soils in capability class VII are not suited to renovation. Tillage is not feasible on these soils, and they are generally kept in native vegetation.

Specialty crops

Because livestock farming is the main type of farming in Eau Claire County, most specialty crops are grown for supplemental income. The acreage in specialty crops on an individual farm is generally small, but the combined production is important to the economy of the county. Soybeans, sweet corn, potatoes, peas for canning, dried beans, snap beans, and horseradish are the main specialty crops. Some strawberries, cabbage, carrots, tomatoes, cucumbers, and melons are also grown.

The soils of Eau Claire County range widely in their suitability for these crops, and in many cases special management is needed to assure good growth. Fertile soils that have high available water capacity, such as those in the Mt. Carroll and Seaton series, are especially well suited to sweet corn, peas, soybeans, cabbage, and snap beans. Soils that have good tilth but have only low or moderate available water capacity are suited to such crops as strawberries, tomatoes, cucumbers, horseradish, and melons. Irrigation and the addition of nutrients are necessary to attain maximum production of crops on these soils.

Information about special management practices needed to grow these crops is available from the county agent or the local office of the Soil Conservation Service. In general the management practices needed for high levels of production of specialty crops are more intensive than those needed for the commonly grown crops.

Capability grouping

Some readers, particularly those who farm on a large scale, may find it practical to use and manage alike some of the different kinds of soils on their farms. These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

The grouping is based on permanent limitations of soils when used for field crops (*30*), the risk of damage when they are farmed, and the way the soils respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations for range, for forest trees, or for engineering.

In the capability system all kinds of soil are grouped at three levels: the class, the subclass, and the unit. The broadest grouping, the capability class, is designated by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitation. In class VIII are soils and land forms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products. (None of the soils in Eau Claire County are in class VIII.) The subclass indicates major kinds of limitations within the classes. Within most of the classes there can be up to 4 subclasses. The subclasses are indicated by adding

a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close growing plant cover is maintained; *w* means 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 some parts of the United States but not in this county, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses w, s, and c, because the soils are subject to little or no erosion but have other limitations that confine their use largely to pasture, range, or wildlife habitat.

Subclasses are further divided into groups called capability units. These are groups of soils that are so much alike that they are suited to the same crops and pasture plants, they require about the same management, and have generally similar productivity and other response to management. Capability units are generally identified by numbers assigned locally, for example, IIe–2 or IIIe–7.

The eight classes in the capability system are described in the list that follow. The capability unit designation for each soil in the county is given in the Guide to Mapping Units and at the end of the soil description in the section "Descriptions of the Soils."

Class I soils have few limitations that restrict their use.

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

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

Class IV soils have very severe limitations that reduce the choice of plants, 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 largely to pasture, woodland, or wildlife habitat.

Class VI soils have very severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or to esthetic purposes.

Management by capability units

In the following paragraphs, the capability units in Eau Claire County are described and suggestions for use and management of the soils in each unit are given. The capability units are not numbered consecutively, because not all of the units used in Wisconsin are in this county. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I–1

This unit consists of nearly level, well drained and moderately well drained soils that are silt loam throughout. These soils formed in thick silty deposits.

Permeability is moderate. Available water capacity is high and very high, and natural fertility is high. Runoff is slow. The hazard of erosion is slight.

The soils in this unit are easy to manage and can be cropped intensively if good tilth is maintained. Minimum tillage, good residue management, cropping sequences, and use of green manure crops help to maintain and improve organic matter content, fertility, and tilth.

If properly managed, these soils are well suited to corn, soybeans, small grain, vegetable crops, grasses, and legumes. They are also well suited to pasture.

CAPABILITY UNIT IIe–1

This unit consists of gently sloping, well drained and moderately well drained soils that have a surface layer of silt loam or loam. These soils are underlain by silt loam or loamy glacial till.

Permeability is moderate and moderately slow. Available water capacity is high and very high, and natural fertility is high or medium. Runoff is slow or medium. The hazard of erosion is slight or moderate.

Controlling erosion is the main concern of management. Maintaining good tilth is also a concern. Such conservation practices as a cropping system that includes a cropping sequence, contour farming, contour stripcropping, diversions, terraces, minimum tillage, and good residue management help to control erosion and maintain good tilth.

If properly managed, these soils are well suited to corn, soybeans, small grain, vegetable crops, grasses, and legumes. They are also well suited to pasture. A few small areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIe–2

This unit consists of gently sloping, well drained soils that have a surface layer of loam or silt loam. These soils have a subsoil that is dominantly loam or silt loam. They are underlain by sand or sandstone bedrock at a depth of 20 to 40 inches.

Permeability is mostly moderate, but some soils in this unit have rapid permeability in the substratum. Available water capacity is moderate, and natural fertility is medium or high. Runoff is slow or medium. The hazard of erosion is slight or moderate.

Controlling erosion and maintaining available water capacity during dry periods are the main concerns of management. Maintaining good tilth is also a concern. Such conservation practices as a cropping system that includes a cropping sequence, contour farming, contour stripcropping, diversions, terraces, minimum tillage, and good residue management help to control

erosion and maintain available water capacity and good tilth.

If properly managed, these soils are well suited to corn, soybeans, small grain, vegetable crops, grasses, and legumes. They are also well suited to pasture. A few small areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIe–6

Only the soils of one mapping unit, Hiles and Kert soils, 2 to 6 percent slopes, are in this unit. Hiles silt loam is well drained and moderately well drained, and Kert loam is somewhat poorly drained. The subsoil of these soils is dominantly heavy loam or silty clay loam. These soils are underlain at a depth of 20 to 40 inches by sandstone bedrock that contains layers of shale.

Permeability is moderate in the subsoil and slow in the substratum. Available water capacity is moderate, and natural fertility is medium. These soils are saturated at a depth of 1 to 5 feet or more during wet periods. Runoff is slow or medium. These soils dry out slowly in spring or following periods of excessive rainfall. The hazard of erosion is slight or moderate.

Controlling erosion, maintaining good tilth, and removing excess water from Kert soils are the main concerns of management. Such conservation practices as a cropping system that includes a cropping sequence, contour farming, contour stripcropping, diversions, terraces, minimum tillage, and good residue management help to control erosion and maintain good tilth. Surface drains and waterways help to remove excess water from wet soils.

If properly managed, the soils in this unit are well suited to corn, soybeans, small grain, grasses, and legumes. They are also well suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIw–1

This unit consists of nearly level, poorly drained and very poorly drained soils that formed in thick, water deposited silty sediment. These soils have a surface layer of silt loam and a subsoil of clay loam or are silt loam throughout.

Permeability is moderate or moderately slow. Available water capacity is high or very high, and natural fertility is high. In undrained areas ground water is at or near the surface during much of the year. Runoff is very slow. These soils receive runoff from adjoining areas, and they are subject to overflow and ponding unless protected. The hazard of erosion is slight. Thin deposits of silty sediment are in some areas following periods of overflow.

The main concern of management is removal of excess water. Maintaining good tilth is also a concern. Deep ditches and, in places, tile drains are effective in lowering the water table. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Surface drainage can be used to remove excess water and prevent ponding. Cultivation at proper moisture content, minimum tillage, a cropping sequence, and good residue management help to maintain good tilth.

If adequately drained and protected from overflow, these soils are suited to corn, soybeans, small grain, grasses, and legumes. Because of wetness, legumes are susceptible to frost heave damage, and small grain tends to lodge. Undrained areas are suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIw–2

Curran silt loam is the only soil in this unit. It is nearly level and somewhat poorly drained. The subsoil is heavy silt loam underlain by strata of silt, fine sand, and medium sand.

Permeability is moderately slow. Available water capacity and natural fertility are high. If undrained, this soil is saturated at a depth of 1 to 3 feet during wet periods. Runoff is slow. These soils dry out slowly in spring or following periods of extended rainfall. The hazard of erosion is slight.

The main concern of management is removal of excess water. Maintaining good tilth and increasing permeability are also concerns. Tile and deep ditch drainage can be used to remove excess water, but in many places surface drains are adequate. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Cultivation at proper moisture content, minimum tillage, cropping sequences, and good residue management help to maintain good tilth. Growing deep rooted crops such as alfalfa increases permeability in the subsoil.

If adequately drained, this soil is suited to corn, soybeans, small grain, vegetable crops, grasses, and legumes. Undrained areas are suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIw–3

Kert loam, 0 to 3 percent slopes, is the only soil in this unit. It is nearly level and gently sloping and is somewhat poorly drained. The subsoil is mainly heavy loam underlain at a depth of 20 to 40 inches by sandstone bedrock that contains layers of shale.

Permeability is moderate to moderately slow. Available water capacity is moderate, and natural fertility is medium. If undrained, this soil is saturated at a depth of 1 to 3 feet during wet periods. Runoff is slow. This soil receives runoff and subsurface seepage from adjoining areas. It dries out slowly in spring and following periods of extended rainfall. The hazard of erosion is slight where this soil is nearly level, but it is moderate where it is gently sloping and slopes are long.

Controlling erosion and removing excess water are the main concerns of management. Maintaining good tilth is also a concern. Surface drains, terraces, diversions, and grassed waterways help in safely disposing of excess water and in controlling erosion. Cultivation at proper moisture content, minimum tillage, a cropping sequence, and good residue management help to maintain good tilth.

If adequately drained, this soil is suited to corn, soybeans, small grain, grasses, and legumes. Undrained areas are suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIw–4

This unit consists of nearly level and gently sloping, somewhat poorly drained soils that have a surface layer of sandy loam. The subsoil is loam, and the underlying material is loam glacial till.

Permeability is moderately rapid in the upper part and moderately slow in the lower part. Available water capacity is high, and natural fertility is medium. If undrained, these soils are saturated at a depth of 1 to 3 feet during wet periods. They dry out slowly in spring or following periods of excessive rainfall. Areas of nearly level soils receive runoff from adjoining areas and are ponded in places for brief periods. In places cobbles and stones interfere with cultivation. Runoff is slow to medium. The hazard of erosion is slight to moderate.

Removing excess water, controlling erosion, and maintaining good tilth are the main concerns of management. Surface drains, terraces, diversions, and grassed waterway help to remove excess water and control erosion. Cultivation at proper moisture content, minimum tillage, a cropping sequence, and good residue management help to maintain good tilth. Growing deep rooted crops such as alfalfa increases permeability in the subsoil after the alfalfa roots die.

If properly managed, these soils are suited to corn, soybeans, small grain, grasses, and legumes. Undrained areas can be used for crops, but wetness delays planting in spring and increases the hazard of crop loss by frost at harvest. Crop growth is better in drained areas than it is in undrained areas, because wetness and the shallow rooting zone caused by seasonal saturation make a good seedbed difficult to prepare. Undrained areas are suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIw–5

This unit consists of nearly level, somewhat poorly drained, poorly drained, and very poorly drained soils that have a surface layer of loam or silt loam. These soils have a subsoil that is dominantly loam or silt loam. They are underlain by sand at a depth of 20 to 40 inches.

Permeability is moderate. Available water capacity is moderate, and natural fertility is medium. If undrained, these soils are saturated at a depth of 0 to 3 feet during wet periods. Runoff is slow or very slow. These soils receive runoff from adjoining areas, and they are subject to ponding in spring or following periods of extended rainfall.

Removal of excess water is the major concern of management. Maintaining good tilth is also a concern. Deep ditches can be used to lower the water table if a suitable outlet is available. Use of tile drainage is questionable, but if tile drains are installed in these soils, precautions must be taken to prevent loose sand from entering and clogging the tile lines. In many areas surface drainage is adequate to drain these soils for most crops. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Cultivation at proper moisture content, minimum tillage, a cropping sequence, and good residue management help to maintain good tilth.

If adequately drained, these soils are suited to corn, soybeans, small grain, certain vegetable crops, grasses, and legumes. In some low areas where there is only partial response to drainage, only forage crops and pasture can be grown. Undrained areas are suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIw–11

This unit consists of well drained to somewhat poorly drained soils that formed in thick silty sediment on bottom land. These soils are silt loam throughout.

Permeability is moderate. Available water capacity is very high, and natural fertility is high. If undrained, these soils are saturated at a depth of 1 to 5 feet or more during wet periods. Runoff is slow. Water is likely to pond for short periods after heavy rainfall. These soils are subject to overflow from runoff from adjoining areas. During periods of overflow channel cutting is a danger, and in places sedimentation causes damage to crops.

Removal of excess water is the main concern of management. Maintaining good tilth is also a concern. Surface drainage, grassed waterways, and diversions help to remove excess water safely and protect these soils from overflow and damaging sedimentation. Cultivation at proper moisture content, minimum tillage, a cropping sequence, and good residue management help to maintain good tilth.

If properly drained and protected from overflow, these soils are suited to corn, soybeans, small grain, grasses, and legumes. Undrained areas are suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIe–1

This unit consists of nearly level and gently sloping, well drained and moderately well drained soils that have a surface layer of loam and silt loam. These soils have a subsoil that is dominantly loam or silt loam. They are underlain by sand at a depth of 20 to 40 inches.

Permeability is moderate or moderately rapid. Available water capacity is moderate, and natural fertility is medium or high. Runoff is slow. The hazard of erosion is slight.

Maintaining good tilth and available water capacity during dry periods are the main concerns of management. These soils are easy to work. Minimum tillage, a cropping sequence, and good residue management help to maintain good tilth and available water capacity.

These soils are suited to corn, soybeans, small grain, vegetable crops, grasses, and legumes. They are also suited to pasture. These soils are well suited to irrigation. If irrigated, they are well suited to intensive cropping of high value crops. A few small areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIIe–1

This unit consists of sloping, well drained and moderately well drained soils that have a surface layer of silt loam and loam. These soils have a subsoil that is

loam or silt loam. They are underlain by silt loam or loamy glacial till.

Permeability is moderate or moderately slow. Available water capacity is high or very high, and natural fertility is high or medium. Runoff is medium to rapid. The hazard of erosion is moderate. In some places cobbles and stones on the surface interfere with tillage.

Controlling erosion is the main concern of management. Maintaining good tilth is also a concern. Such conservation practices as a cropping system that includes a cropping sequence, contour farming, contour stripcropping, diversions, terraces, grassed waterways, minimum tillage, and good residue management help to control erosion and maintain good tilth.

If properly managed, these soils are moderately well suited to corn, soybeans, small grain, grasses, and legumes. They are also suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIIe–2

This unit consists of sloping, well drained soils that have a surface layer of loam. These soils have a subsoil that is dominantly loam or silt loam. They are underlain by sand or sandstone bedrock at a depth of 20 to 40 inches.

Permeability is moderate. Available water capacity is moderate, and natural fertility is medium. Runoff is medium. The hazard of erosion is moderate.

Controlling erosion and maintaining available water capacity during dry periods are the main concerns of management. Maintaining good tilth is also a concern. Such conservation practices as a cropping system that includes a cropping sequence, contour farming, contour stripcropping, diversions, terraces, grassed waterways, minimum tillage, and good residue management help to control erosion and maintain available water capacity and good tilth.

If properly managed, these soils are moderately well suited to corn, soybeans, small grain, grasses, and legumes. They are also suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIIe–3

This unit consists of nearly level and gently sloping, somewhat excessively drained to moderately well drained soils that have a surface layer of loamy sand, sandy loam, loam, or silt loam. These soils have a subsoil that is loamy sand, sandy loam, loam, silt loam, or silty clay. They are underlain by sand and gravel or sandstone bedrock. In places the sandstone bedrock has strata of shale. Depth to the underlying material ranges from 10 to 40 inches.

Permeability is mostly moderate or moderately rapid. Some soils in this unit have moderate or rapid permeability in the upper part and moderately slow permeability in the lower part. Available water capacity is low, and natural fertility is low or medium. Runoff is slow or medium. The hazard of erosion is slight or moderate. Some soils in this unit have a restricted root zone. Cultivation has exposed pebbles or sandstone fragments in many thin and eroded areas.

Controlling erosion and maintaining available water capacity are the main concerns of management. Maintaining good tilth is also a concern. Such conservation practices as a cropping system that includes a cropping sequence, contour farming, contour stripcropping, grassed waterways, minimum tillage, and good residue management help to control erosion, increase infiltration, and maintain available water capacity and good tilth. These soils are difficult to till in areas where the soil is eroded.

If properly managed, these soils are moderately well suited to corn, soybeans, small grain, grasses, and legumes. Damage to crops from drought occurs rapidly during dry periods. Some soils in this unit are suited to irrigation. If irrigated, they are suited to more intensive cropping. These soils are also suited to pasture. Many areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIIe–6

Hiles silt loam, 6 to 12 percent slopes, eroded, is the only soil in this unit. It is sloping and well drained and moderately well drained. The subsoil is silt loam and silty clay loam underlain at a depth of 20 to 40 inches by sandstone bedrock that contains layers of shale.

Permeability is moderate in the subsoil and slow in the substratum. Available water capacity is moderate, and natural fertility is medium. Some areas of this soil are saturated at a depth of 3 to 5 feet during wet periods. This seasonal water table is caused mainly by downslope seepage over the sandstone and shale bedrock. This soil dries out slowly in spring or following periods of excessive rainfall. Runoff is medium. The hazard of erosion is moderate.

Controlling erosion and maintaining good tilth are the main concerns of management. Such conservation practices as a cropping system that includes a cropping sequence, contour farming, contour stripcropping, diversions, terraces, minimum tillage, and good residue management help to control erosion and maintain good tilth. In areas of eroded soils that have an exposed silty clay loam subsoil, the soil is difficult to till.

If properly managed, this soil is moderately well suited to corn, soybeans, small grain, grasses, and legumes. It is also suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIIe–7

This unit consists of sloping, well drained and somewhat excessively drained soils that have a surface layer of sandy loam. These soils have a subsoil of sandy loam. They are underlain by sand or sandstone bedrock at a depth of 20 to 40 inches.

Permeability is moderate or moderately rapid. Available water capacity is low, and natural fertility is low or medium. Runoff is medium. The hazard of erosion is moderate. These soils are moderately droughty.

Controlling erosion, maintaining available water capacity, and providing plant nutrients are the main concerns of management. Such conservation practices as a cropping system that includes contour farming,

contour stripcropping, diversions, grassed waterways, minimum tillage, cover crops, a cropping sequence, and good residue management help to control erosion and maintain available water capacity.

If properly managed, these soils are moderately well suited to corn, soybeans, small grain, grasses, and legumes. Seedling mortality is a hazard, especially for small seeded crops. It is better to plant early in spring before the soil has a chance to dry than to plant later. Crop production is moderately limited by droughtiness. These soils are also suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIIw–3

This unit consists of nearly level, poorly drained soils that have a surface layer of loam. These soils have a subsoil of sandy loam or loam. They are underlain at a depth of 20 to 40 inches by thick deposits of sandy loam glacial till or sandstone that has layers of shale.

Permeability is moderate to very slow. Available water capacity is moderate, and natural fertility is medium. In undrained areas ground water is at or near the surface throughout the year. These soils receive runoff from adjoining areas and are subject to ponding. Runoff is very slow. These soils remain wet for extended periods in spring or following heavy rainfall.

Removing excess water, maintaining good tilth, and controlling frost damage to crops in places are the main concerns of management. Surface drains and deep ditches help to remove excess water. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Cultivation at proper moisture content, minimum tillage, a cropping sequence, and good residue management help to maintain good tilth.

If adequately drained, these soils are suited to corn, small grain, grasses, and legumes. Because of wetness and the frost hazard, much of the corn is harvested for silage, and small grain tends to lodge. In many areas clover is grown for hay and pasture instead of alfalfa. Many areas are used for permanent pasture, woodland, or wildlife habitat.

CAPABILITY UNIT IIIw–6

This unit consists of nearly level and gently sloping, somewhat poorly drained soils that have a surface layer of loamy sand and sandy loam. These soils have a subsoil of sand and loam. They are underlain at a depth of 20 to 40 inches by sandstone bedrock that has layers of shale.

Permeability is moderate or rapid in the upper part of the soil and moderately slow or slow in the substratum. Available water capacity and natural fertility are low. If undrained, these soils are saturated at a depth of 1 to 3 feet during wet periods. This wetness is caused by downslope seepage over the sandstone and shale bedrock and by runoff from adjoining areas. These soils dry out slowly in spring or following periods of excessive rainfall. When the water table recedes in mid or late summer, these soils tend to be droughty. Runoff is slow to medium. The hazard of erosion is slight.

Removing excess water, controlling erosion on gently sloping soils, and providing plant nutrients are the main concerns of management. Surface drainage, terraces, diversions, and grassed waterways help to remove excess water and control erosion. Minimum tillage, a cropping sequence, good residue management, and regular applications of fertilizer help to maintain the organic matter content and a favorable fertility level.

If drained, these soils are suited to corn, small grain, grasses, and legumes. Undrained areas can be used for crops, but wetness delays planting in the spring and increases the hazard of crop loss by frost at harvest. These soils are also suited to pasture. Most areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIIw–12

Caryville loam, 0 to 3 percent slopes, is the only soil in this unit. This nearly level and gently sloping, well drained soil is underlain by loamy sand and sand at a depth of 10 to 20 inches.

Permeability is moderate in the upper part of the soil and rapid in the underlying material. Available water capacity and natural fertility are low. Runoff is slow. This soil is subject to flooding. Shallow depth to sand makes this soil somewhat droughty.

Controlling flooding and maintaining available water capacity are the main concerns of management. Maintaining organic matter content is also a concern. In some areas dikes can be used to protect this soil from flooding. In many areas, however, there is major inundation on an entire flood plain, and diking or other flood control measures are not feasible. The flooding is commonly in spring, is of short duration, and generally does not seriously affect most crops commonly grown in the area. Minimum tillage, a crop ping sequence, and good residue management help to maintain organic matter content and available water capacity. This soil is easy to till.

If properly managed, this soil is suited to corn, soybeans, small grain, vegetable or specialty crops, grasses, and legumes. During dry seasons crop production is somewhat lower because of low available water capacity This soil is well suited to irrigation. If irrigated, it is suited to more intensive cropping. This soil is also suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IIIs–4

This unit consists of nearly level and gently sloping, somewhat excessively drained to moderately well drained soils that have a surface layer of sandy loam. These soils have a subsoil that is dominantly sandy loam or loamy sand. They are underlain by sand or sandstone at a depth of 20 to 40 inches.

Permeability is moderate or moderately rapid. Available water capacity is mainly low, and natural fertility is low or medium. All of these soils tend to be droughty. Runoff is slow. The hazard of water erosion is mainly slight. Some soils are subject to soil blowing.

Controlling water erosion and soil blowing, providing plant nutrients, and maintaining available water capacity are the main concerns of management. Such

conservation practices as a cropping system that includes contour farming, a cropping sequence, stripcropping (fig. 9), field windbreaks, minimum tillage, good residue management, and use of cover crops help to control erosion and soil blowing and maintain available water capacity and organic matter content.

If properly managed, these soils are moderately well suited to corn, soybeans, small grain, grasses, and legumes. It is better to plant early in spring before the soil has a chance to dry than to plant later in spring. Later plantings, especially of small seeded crops, are likely to have a poor survival rate. Some soils in this unit are suited to irrigation. If irrigated, they are suited to more intensive cropping. These soils are also suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IVe–1

Seaton silt loam, 12 to 20 percent slopes, eroded, is the only soil in this unit. This well drained, moderately steep soil formed in thick silt loam deposits.

Permeability is moderate. Available water capacity is very high, and natural fertility is high. Runoff is rapid. The hazard of erosion is severe. In most areas that have been cultivated, the soil has lost as much as 6 inches of the original surface layer by erosion.

Controlling erosion is the main concern of management. Maintaining good tilth is also a concern. Such conservation practices as a cropping system that includes contour farming, contour stripcropping, diversions, grassed waterways, minimum tillage, a cropping sequence, and good residue management help to control erosion and maintain good tilth.

This soil is not well suited to intensive row cropping. If proper management and a cropping system that includes a high proportion of hay crops are used, this soil is suited to small grain, grasses, legumes, and some corn and soybeans. This soil is also suited to pasture. Some areas are used for woodland or wildlife habitat.

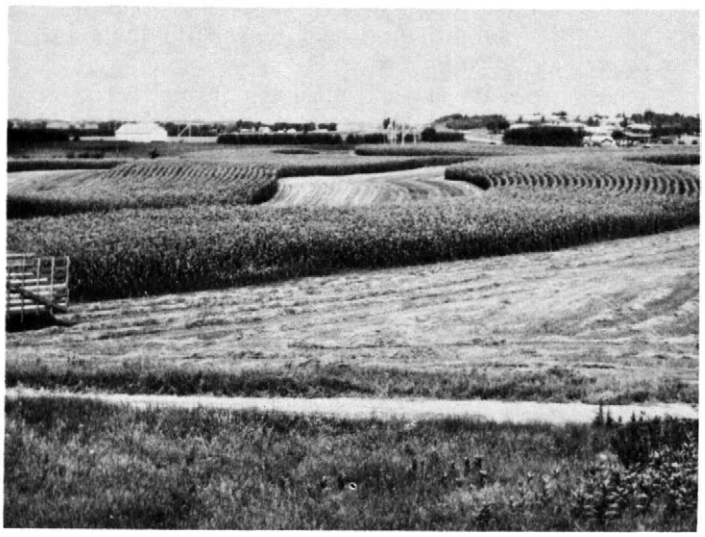

Figure 9.—**Contour stripcropping on a Billett soil, capability unit IIIs–4.**

CAPABILITY UNIT IVe–2

This unit consists of moderately steep, well drained or somewhat excessively drained soils that have a surface layer of very fine sandy loam, loam, or silt loam. They are underlain by sandstone bedrock at a depth of 20 to 40 inches.

Permeability is moderate. Available water capacity is moderate, and natural fertility is medium. Runoff is rapid. The hazard of erosion is severe. In most areas that have been cultivated, the soil has lost as much as 6 inches of the original surface layer by erosion.

Controlling erosion and maintaining available water capacity and good tilth are the main concerns of management. Such conservation practices as a cropping system that includes contour farming, contour stripcropping, diversions, grassed waterways, minimum tillage, a cropping sequence, and good residue management help to control erosion and maintain good tilth and available water capacity. These soils are difficult to work because of slope and because of the poor tilth of eroded soils.

These soils are not well suited to row crops. If proper management and a cropping system that includes a high proportion of hay crops are used, these soils are suited to small grain, grasses, legumes, and some corn and soybeans. Growth of crops is slightly affected by droughtiness, particularly during seasons of little or poorly distributed rainfall. Many areas of these soils are in permanent pasture. These soils are also used for woodland or wildlife habitat.

CAPABILITY UNIT IVe–3

This unit consists of sloping, somewhat excessively drained to moderately well drained soils that have a surface layer of loamy sand, sandy loam, loam, or silt loam. These soils have a subsoil that is loamy sand, sandy loam, loam, silt loam, or silty clay. They are underlain by sand and gravel, sandstone bedrock, or sandstone bedrock that has strata of shale. Depth to underlying material ranges from 10 to 40 inches.

Permeability is mostly moderate or moderately rapid. Some soils in this unit have moderate or rapid permeability in the upper part and moderately slow permeability in the lower part. Available water capacity is low, and natural fertility is low or medium. Runoff is medium. The hazard of erosion is moderate. Some soils in this unit have a restricted root zone. Cultivation has exposed pebbles or sandstone fragments at the surface of some thin and eroded soils.

Controlling erosion, maintaining available water capacity and good tilth, and providing plant nutrients are the main concerns of management. Such conservation practices as a cropping system that includes contour farming, contour stripcropping, grassed waterways, minimum tillage, a cropping sequence, and good residue management help to control erosion and maintain available water capacity and good tilth. Thin and eroded soils are difficult to till.

These soils are not well suited to row crops. If proper management and a cropping system that

includes a high proportion of hay crops are used, these soils are suited to small grain, grasses, legumes, and some corn and soybeans. Because these soils are droughty, cultivated areas are generally maintained in hay crops or pasture. Most of the soils in this unit are used for woodland. These soils are also used for wildlife habitat.

CAPABILITY UNIT IVe–7

This unit consists of moderately steep, well drained and somewhat excessively drained soils that have a surface layer and subsoil of sandy loam. These soils are underlain by sand or sandstone bedrock at a depth of 20 to 40 inches.

Permeability is moderate or moderately rapid. Available water capacity is low, and natural fertility is low or medium. Runoff is rapid. The hazard of erosion is severe. In most areas that have been cropped, the soil has lost as much as 6 inches of the original surface layer by erosion. These soils are moderately droughty.

Controlling erosion, maintaining available water capacity, and providing plant nutrients are the main concerns of management. Such conservation practices as a cropping system that includes contour farming, contour stripcropping, diversions, grassed waterways, minimum tillage, a cropping sequence, use of cover crops, and good residue management help to control erosion and maintain available water capacity.

These soils are not well suited to row crops. If management is good and a high proportion of hay crops is used in the cropping sequence, these soils are suited to small grain, legumes, and some corn. Crop production is moderately to severely limited because these soils are droughty. These soils are also suited to pasture. Some areas are used for woodland or wildlife habitat.

CAPABILITY UNIT IVw–3

Veedum silt loam is the only soil in this unit. The subsoil is loam in the upper part and silt loam in the lower part. This soil is underlain at a depth of 20 to 40 inches by sandstone that has layers of shale.

Permeability is moderately slow to very slow. Available water capacity is moderate, and natural fertility is medium. In undrained areas ground water is at or near the surface throughout the year. This soil receives runoff from adjoining areas and is subject to ponding. Runoff is very slow. If undrained, this soil remains wet throughout the year and cannot be cropped.

Removing excess water, maintaining good tilth, and controlling frost damage to crops are the main concerns of management. Surface drains and deep ditches help to remove excess water. Diversions and grassed waterways can be used to intercept and safely remove runoff from adjoining areas. Cultivation at proper moisture content, minimum tillage, a cropping sequence, and good residue management help to maintain good tilth.

If adequately drained, this soil is suited to corn, small grain, grasses, and legumes. Because of wetness and the frost hazard, most of the corn is harvested for silage, and small grain tends to lodge. Clover, such as Ladino, is generally grown instead of alfalfa because of the wetness and acidity of this soil. Most areas of this soil are undrained and are in permanent pasture, woodland, or wildlife habitat.

CAPABILITY UNIT IVw–5

This unit consists of nearly level, somewhat poorly drained and poorly drained soils that have a surface layer of loamy sand. These soils have a subsoil that is loamy sand or sand. They are underlain by sandstone and shale bedrock or sand.

Permeability is mostly rapid, but some soils in this unit have slow permeability in the lower part. Available water capacity is low or very low, and natural fertility is low. Somewhat poorly drained soils are saturated at a depth of 1 to 3 feet during wet periods. Poorly drained soils have ground water at or near the surface throughout much of the year. Runoff is slow. These soils are subject to ponding in spring or following periods of excessive rainfall.

Controlling wetness and increasing fertility are the main concerns of management. Maintaining available water capacity during extended dry periods or in overdrained areas can also be a concern.

If drained, these soils are not well suited to most crops commonly grown in the county. Few areas of these soils are drained and cropped for this reason. Most areas are used for pasture or woodland. These soils are also used for wildlife habitat.

CAPABILITY UNIT IVw–7

This unit consists of nearly level, very poorly drained organic soils that are underlain by sand at a depth of 16 to 51 inches.

Permeability is rapid. Available water capacity is high, and natural fertility is low. Frost action is a hazard, especially on more northerly soils. In undrained areas ground water is at or near the surface throughout the year. These soils receive runoff from adjoining areas and are subject to ponding. If drained, these soils are subject to soil blowing, burning, and subsidence.

If these soils are used for crops, the main concerns of management are removing excess water and increasing natural fertility. These soils are deficient in phosphorus and potash. Controlling frost damage to crops is also a concern. Deep ditches can be used to lower the water table if a suitable outlet is available. Tiling is not generally used on these soils because of the hazard of sand entering and clogging the tile drains. Diversions and grassed waterways in adjoining areas can be used to intercept and safely divert runoff that increases wetness on these soils. Large initial applications of fertilizer are needed to overcome low natural fertility.

If adequately drained and protected from soil blowing, these soils are used for corn, pasture, and certain vegetable crops. The frost hazard needs to be considered in determining cropping and the selection of crops. These soils respond well to applications of ferti-

lizer and can support a large population of plants. If properly managed, these soils can be cropped intensively, but oxidation and subsidence reduce the thickness of the organic layer or can eventually completely destroy this layer under long term intensive cropping. Most areas of these soils are undrained and support marsh grass, reeds, and alder. These areas are used for wildlife habitat.

CAPABILITY UNIT IVw–9

Houghton muck is the only soil in this unit. It is a nearly level, very poorly drained organic soil that is more than 51 inches thick.

Permeability is rapid. Available water capacity is very high, and natural fertility is low. Frost action is a hazard. In undrained areas ground water is at or near the surface throughout the year. This soil receives runoff from adjoining areas and is subject to ponding. If drained and cultivated, this soil is subject to subsidence, soil blowing, and burning.

If this soil is used for crops, the main concerns of management are removing excess water and increasing natural fertility. This soil is deficient in phosphorus and potash. Controlling frost damage to crops is also a concern. Deep ditches and tile drainage can be used to lower the water table if a suitable outlet is available. Controlled drainage helps to control subsidence, soil blowing, and burning. Diversions and grassed waterways in adjoining areas can be used to intercept and safely divert runoff that increases wetness on this soil. Large initial applications of fertilizer are needed to overcome low natural fertility.

If adequately drained and protected from soil blowing, this soil is used for corn, pasture, vegetable crops, and bluegrass sod. The frost hazard needs to be considered in the selection of crops. This soil responds well to applications of fertilizer. If properly managed, this soil can be intensively cropped. Undrained areas can be used for pasture, but they are generally used for wetland wildlife habitat.

CAPABILITY UNIT IVs–3

This unit consists of nearly level to sloping, excessively drained to moderately well drained soils that have a surface layer of loamy sand. These soils have a subsoil of loamy sand or sand. They are underlain by sand or sandstone bedrock.

Permeability is rapid or very rapid. Available water capacity is low or very low, and natural fertility is low. Some soils are saturated at a depth of 3 to 5 feet during wet periods. Runoff is slow on nearly level to gently sloping soils and medium on sloping soils.

Controlling soil blowing and water erosion and maintaining organic matter content and available water capacity are the main concerns of management. Such conservation practices as a cropping system that includes close growing crops, field stripcropping, windbreaks, minimum tillage, good residue management, a cropping sequence, and use of cover crops help to control soil blowing and maintain organic matter content and available water capacity. Contour farming and contour stripcropping help to control erosion on sloping soils. Regular applications of fertilizer reduce soil blowing and erosion by helping to maintain plant cover.

If properly managed, these soils are moderately well suited to row crops, small grain, and hay. Some crops respond quickly to drought, and their growth is generally poor. Deep rooted crops are less susceptible to damage from drought. The hazard of seedling mortality is moderate to severe. Nearly level and gently sloping soils are suited to irrigation. If irrigated, they are suited to more intensive cropping. These soils are also suited to pasture. Many pine plantations and windbreaks are established on these soils. Many areas are used for woodland or wildlife habitat.

CAPABILITY UNIT Vw–14

Only Alluvial land, wet, is in this unit. This nearly level, poorly drained land type is on flood plains. It formed in sandy or loamy sediment.

Meandering stream channels, oxbows, sloughs, and frequent flooding limit the use of this land type. Permeability and natural fertility are too variable to be rated. Available water capacity is moderate to high. In undrained areas ground water is at or near the surface throughout the year.

Drainage and protection from flooding are generally impractical. Many areas of this land type are in woods or pasture. This land type is used for pasture, woodland, or wetland wildlife habitat.

CAPABILITY UNIT VIe–1

Seaton silt loam, 20 to 30 percent slopes, eroded, is the only soil in this unit. This steep, well drained soil formed in thick silt loam deposits.

Permeability is moderate. Available water capacity is very high, and natural fertility is high. Runoff is very rapid. The hazard of erosion is very severe. Most areas that have been cultivated have lost as much as 6 inches of the original surface layer by erosion. In most of these areas, the subsoil is exposed.

Controlling soil loss by erosion and preventing soil deterioration are the main concerns of management. Controlled grazing, renovation, and fertilization help to maintain adequate plant cover and control erosion.

Because of the very severe erosion hazard and steep slopes, this soil is generally unsuited to cultivated crops. If properly managed, this soil is suited to pasture and hay. This soil is used for woodland or wildlife habitat.

CAPABILITY UNIT VIe–2

This unit consists of steep, well drained soils that have a surface layer of silt loam. These soils have a subsoil that is very fine sandy loam, loam, or silt loam. They are underlain by sandstone bedrock at a depth of 20 to 40 inches.

Permeability is moderate. Available water capacity is moderate, and natural fertility is medium. Runoff is very rapid. The hazard of erosion is very severe. Most areas that have been cultivated have lost as much as 6

inches of the original surface layer by erosion. In most of these areas the subsoil is exposed.

Controlling erosion, preventing soil deterioration, and maintaining available water capacity are the main concerns of management. Controlled grazing, renovation, and fertilization help to maintain adequate plant cover and available water capacity and control erosion.

Because of the very severe erosion hazard and steep slopes, these soils are generally unsuited to cultivated crops. If properly managed, they are suited to pasture and hay. Growth of hay and pasture crops is inhibited slightly because these soils are droughty, particularly during seasons of little or poorly distributed rainfall. Many areas of these soils are in permanent pasture or woods. These soils are also used for wildlife habitat.

CAPABILITY UNIT VIe–3

This unit consists of moderately steep, somewhat excessively drained and well drained soils that have a surface layer of sandy loam, loam, and silt loam. These soils have a subsoil that is gravelly loamy sand, sandy loam, loam, and silt loam. They are underlain by sand and gravel or sandstone bedrock at a depth of 10 to 20 inches.

Permeability is moderate or moderately rapid. Available water capacity is low, and natural fertility is low or medium. Runoff is rapid. The hazard of erosion is severe. The root zone is restricted by the underlying sand and gravel or sandstone bedrock.

Controlling soil loss by erosion, preventing soil deterioration, and maintaining available water capacity are the main concerns of management. Controlled grazing, pasture renovation, and fertilization help to control erosion and maintain adequate plant cover and available water capacity.

Because of the severe erosion hazard, shallow root zone, and low available water capacity, these soils are generally unsuited to cultivated crops. If properly managed, they are suited to hay and pasture. Growth is generally poor, however, especially during dry seasons or seasons of poorly distributed rainfall. Many areas of these soils are used for woodland and wildlife habitat.

CAPABILITY UNIT VIs–3

This unit consists of sloping, excessively drained soils that have a surface layer of loamy sand. These soils have a subsoil that is loamy sand or sand. They are underlain by sand or sandstone bedrock.

Permeability is rapid. Available water capacity is very low, and natural fertility is low. Runoff is medium. The hazard of water erosion is moderate. These soils are susceptible to soil blowing.

Controlling water erosion and soil blowing and maintaining organic matter content and available water capacity are the main concerns of management Controlled grazing, pasture renovation, and fertilization help to maintain plant cover and available water capacity and control erosion and soil blowing.

Because of low available water capacity and the hazard of soil blowing, these soils are generally unsuited to cultivated crops. If properly managed, these soils are suited to pasture or hay, but production is low. It is better to plant pasture and hay early in spring before the soil has a chance to dry than to plant later. (Later plantings are likely to have a poor survival rate.) Many areas of these soils are in woodlots or are established in pine plantations. Some areas are used for wildlife habitat.

CAPABILITY UNIT VIIe–2

Urne very fine sandy loam, 20 to 45 percent slopes, is the only soil in this unit. The subsoil is very fine sandy loam underlain by sandstone bedrock at a depth of 20 to 40 inches.

Permeability is moderate. Available water capacity is moderate, and natural fertility is medium. Runoff is very rapid. The hazard of erosion is very severe.

Controlling soil loss by erosion and preventing soil deterioration are the main concerns of management.

Because of steep slopes and the very severe erosion hazard, this soil is unsuited to cultivated crops. Areas of less steep soil can be renovated and maintained in pasture if grazing is carefully controlled. Most areas of this soil are used for woodland or wildlife habitat.

CAPABILITY UNIT VIIe–3

This unit consists of steep and very steep, well drained soils that have a surface layer of loam or silt loam and a subsoil of loam or silt loam. They are underlain by sandstone bedrock at a depth of less than 20 inches.

Permeability is moderate. Available water capacity is low, and natural fertility is low or medium. Runoff is very rapid. The hazard of erosion is very severe. The root zone is restricted by the underlying sandstone bedrock. In places bedrock outcrops are at the surface.

Controlling soil loss by erosion and preventing soil deterioration are the main concerns of management. Maintaining some kind of permanent plant cover helps to control erosion and soil damage.

Because these soils are steep and very steep and are erodible, they are unsuited to cultivation. Some areas are used for pasture, but they require very careful management to control erosion and soil damage. Most areas are used for woodland or wildlife habitat.

CAPABILITY UNIT VIIs–9

This unit consists of nearly level to very steep, excessively drained sandy soils and land types. The subsoil is sand or loamy sand underlain by sand or sandstone bedrock.

Permeability is rapid or very rapid. Available water capacity is low or very low, and natural fertility is low. Runoff is mostly slow or medium, but it is rapid on the moderately steep to very steep soils. The hazard of water erosion is slight on nearly level and gently sloping soils, moderate on sloping soils, and severe on moderately steep to very steep soils. These soils have a severe limitation because of droughtiness, and they are subject to soil blowing. Some land types in this unit are subject to flooding.

Controlling erosion and soil blowing are the main

concerns of management. Maintaining a permanent plant cover, such as grass or trees, helps to control erosion and soil blowing.

These soils and land types are unsuited to crops or pasture. Because they are droughty, plant cover is difficult to establish and maintain. Most areas of these soils and land types are in woods or are planted to pine trees (fig. 10). Some areas are used for wildlife habitat.

CAPABILITY UNIT VIIIs–10

Only the land type Riverwash is in this unit. It is made up of infertile sandy and gravelly material recently deposited by streams. Riverwash is nearly level and excessively drained.

Permeability is rapid. Available water capacity is very low, and natural fertility is low. This land type is frequently flooded, and it is subject to much shifting and changing during the periods of flooding. Many areas receive additional deposits of sand or gravel at these times.

Because it is very droughty and is flooded frequently, this land type supports little or no vegetation. It is mainly suited to selected recreational uses.

Predicted yields

Predicted average yields per acre of the principal crops grown in Eau Claire County are listed in table 2. The yields are averages of those expected over a period of years under a high level of management (*4*). The predictions are based on interviews with farmers, on results obtained by agricultural experiment stations, and on observations by soil scientists and other farm workers who are familiar with the soils.

***Figure 10.*—Pine plantation in area of Boone-Plainbo soils, Capability class VII.**

Under a high level of management, surface and internal drainage is adequate, soils are limed to a reaction of about pH 6.5, fertilizer is applied according to the needs indicated by soil tests, seedbed preparation and proper planting methods are timely and adequate, harvesting is timely and is carefully performed, erosion is controlled continually by adequate measures, cropping systems are adapted to the soil and the slope, and weeds and insects are controlled. In addition to this, the following practices are carried out during high level management of corn, oats, and alfalfa-brome hay:

Corn.—Fertilizer is applied according to soil tests based on the expected production of a particular soil over a period of years. Abundant organic matter is supplied by returning crop residue to the soils and applying barnyard manure. Good soil structure is maintained through minimum tillage. Corn of suitable relative maturity is grown. Seeding rates are adjusted to get a plant population adequate to produce the expected yield. Weeds and harmful insects are thoroughly controlled.

Oats.—Fertilizer is applied according to soil tests. Clean, viable seed of adapted varieties is planted at recommended rates, at shallow depths, and as early in spring as possible. Only short, stiff strawed varieties are planted on fertile soils. Oat stubble is clipped and removed after harvest.

Alfalfa-brome hay.—Fertilizer and lime are applied according to soil tests. Varieties that are resistant to disease and winter-kill are seeded. Cutting is at the proper time to allow two or three crops to be harvested during an average growing season. Little or no grazing occurs in fall. Each fall the crop is topdressed with manure or with commercial fertilizer that is high in potassium and contains borax, if needed in the particular area.

Use of the Soils for Woodland[3]

At the time Eau Claire County was settled, most areas of it were at least partly wooded. In the southern and western parts of the county, woodland of open grown oak was intermingled with such prairie grasses as big and little bluestem, switchgrass, indiangrass, and other prairie plants. Most of the woodland in the northeastern part of the county was of the "pine barren" type, but a small area of northern hardwoods was in the extreme northeast corner (*7*).

An inventory in 1968 listed 158,500 acres, or about 38 percent of the county, as commercial forest. This forest was about 41 percent oak and hickory; 5 percent elm, ash, and cottonwood; and 4 percent nonstocked (*31*).

A large acreage that once was farmed is now used as woodland. Red pine, white pine, and some jack pine have been planted on sandy soils of the Friendship, Plainbo, Plainfield, Menahga, and Sparta series. These plantings are an important part of the soil and water

[3] By GEORGE W. ALLEY, forester, Soil Conservation Service, Madison, Wisconsin.

TABLE 2.—*Predicted average yields per acre of principal crops under an improved, or high, level of management*

[Absence of a yield figure indicates that the soil is not suited to the crop, or that the crop is not ordinarily grown in the soil]

Map symbol	Soil name	Corn		Oats [1]	Alfalfa-brome hay [2] (dry weight)
		Grain	Silage		
		Bu	*Tons*	*Bu*	*Tons*
Ad	Adrian muck	90	17.0	50	
Ae	Alluvial land, sandy [3]				
Af	Alluvial land, wet [3]				
ArA	Arenzville silt loam, 0 to 3 percent slopes [4]	120	19.0	70	4.0
AtB	Arland sandy loam, 2 to 6 percent slopes	75	13.0	65	3.5
AtC2	Arland sandy loam, 6 to 12 percent slopes, eroded	70	12.0	60	3.0
AtD2	Arland sandy loam, 12 to 20 percent slopes, eroded	65	11.0	50	2.5
Au	Au Gres loamy sand	50	8.0	55	2.5
BlB	Billett sandy loam, 1 to 6 percent slopes	70	13.0	60	2.8
BlC2	Billett sandy loam, 6 to 12 percent slopes, eroded	60	9.0	50	2.2
BlD2	Billett sandy loam, 12 to 20 percent slopes, eroded	55	9.0	45	2.0
BmA	Billett sandy loam, moderately well drained, 0 to 3 percent slopes	85	14.0	65	3.0
BoB	Boone-Plainbo complex, 2 to 6 percent slopes				
BoC	Boone-Plainbo complex, 6 to 12 percent slopes				
BoE	Boone-Plainbo complex, 12 to 45 percent slopes				
BuA	Burkhardt sandy loam, 0 to 3 percent slopes	65	11.5	50	2.5
Cb	Cable loam		12.0	55	
CeA	Caryville loam, 0 to 3 percent slopes [4]	75	12.5	60	3.0
CkB	Chetek sandy loam, 1 to 6 percent slopes	60	11.0	50	2.5
CkC2	Chetek sandy loam, 6 to 12 percent slopes, eroded	55	10.0	45	2.5
CkD2	Chetek sandy loam, 12 to 20 percent slopes, eroded				1.5
Cu	Curran silt loam	90	14.0	80	3.5
DaA	Dakota loam, 0 to 3 percent slopes	85	13.0	60	3.0
De	Dells silt loam	100	14.0	80	4.5
DuA	Dunnville sandy loam, 0 to 3 percent slopes	70	12.0	55	2.75
ElB	Eleva sandy loam, 2 to 6 percent slopes	75	13.0	55	2.5
ElC2	Eleva sandy loam, 6 to 12 percent slopes, eroded	70	12.0	50	2.5
ElD2	Eleva sandy loam, 12 to 20 percent slopes, eroded	65	11.0	45	2.0
EmB	Elkmound loam, 2 to 6 percent slopes	70	12.0	55	2.8
EmC2	Elkmound loam, 6 to 12 percent slopes, eroded	55	9.0	45	2.0
EmD2	Elkmound loam, 12 to 20 percent slopes, eroded			40	1.8
EmE	Elkmound loam, 20 to 45 percent slopes				
Eo	Elm Lake loamy sand	60	10.0	45	2.5
Er	Ettrick silt loam [4]	115	19.0	60	4.0
FmA	Fairchild and Merrillan soils, 0 to 2 percent slopes	70	11.0	50	2.5
FmB	Fairchild and Merrillan soils, 2 to 6 percent slopes	70	11.0	50	2.5
FoA	Fallcreek sandy loam, 0 to 2 percent slopes	80	13.0	70	3.75
FoB	Fallcreek sandy loam, 2 to 6 percent slopes	80	13.0	70	3.75
FpB	Fallcreek loam, moderately well drained variant, 2 to 6 percent slopes	80	13.0	70	3.5
FpC	Fallcreek loam, moderately well drained variant, 6 to 12 percent slopes	75	12.0	70	3.5
FrA	Friendship loamy sand, 0 to 3 percent slopes	50	8.0	40	2.5
GaB	Gale silt loam, 2 to 6 percent slopes	90	15.0	65	3.5
GaC2	Gale silt loam, 6 to 12 percent slopes, eroded	85	14.0	60	3.5
GaD2	Gale silt loam, 12 to 20 percent slopes, eroded	80	12.0	55	3.0
GaE	Gale silt loam, 20 to 30 percent slopes				
GoB	Gotham loamy sand, 1 to 6 percent slopes	65	11.0	50	2.5
GoC2	Gotham loamy sand, 6 to 12 percent slopes, eroded	60	10.0	50	2.0
GsB	Gotham loamy sand, sandstone substratum, 2 to 6 percent slopes	65	11.0	50	2.5
GsC2	Gotham loamy sand, sandstone substratum, 6 to 12 percent slopes, eroded	60	10.0	50	2.5
HeC2	Hiles silt loam, 6 to 12 percent slopes, eroded	75	12.0	55	3.0
HkB	Hiles and Kert soils, 2 to 6 percent slopes	80	12.0	55	3.5
HnB	Hixton loam, 2 to 6 percent slopes	90	13.0	65	3.5
HnC2	Hixton loam, 6 to 12 percent slopes, eroded	80	11.0	60	3.5
HnD2	Hixton loam, 12 to 20 percent slopes, eroded	70	10.0	50	3.0
Ho	Houghton muck		12.0		
KeA	Kert loam, 0 to 3 percent slopes	80	13.0	60	3.5
La	Lows loam	70	12.0	60	3.0
LuB	Ludington and Humbird soils, 2 to 6 percent slopes	55	10.0	45	2.5
LuC	Ludington and Humbird soils, 6 to 12 percent slopes	50	9.0	40	2.5
Ma	Markey muck	80	15.0		
Mc	Marshan loam	90	16.0	50	
MdB	Menahga sand, 1 to 6 percent slopes				
MdC	Menahga sand, 6 to 12 percent slopes				
MeA	Meridian loam, 0 to 2 percent slopes	80	13.5	60	3.5
MeB	Meridian loam, 2 to 6 percent slopes	80	13.0	55	3.5
MeC2	Meridian loam, 6 to 12 percent slopes, eroded	75	12.5	50	3.0

TABLE 2.—*Predicted average yields per acre of principal crops under an improved, or high, level of management*—Continued

Map symbol	Soil name	Corn		Oats [1]	Alfalfa-brome hay [2] (dry weight)
		Grain	Silage		
		Bu	*Tons*	*Bu*	*Tons*
MmA	Meridian loam, moderately well drained, 0 to 3 percent slopes	80	13.0	55	3.5
Mo	Morocco loamy sand	60	10.0	50	2.5
MrB	Mt. Carroll silt loam, 2 to 6 percent slopes	115	19.0	80	5.0
MrC2	Mt. Carroll silt loam, 6 to 12 percent slopes, eroded	110	18.0	75	4.5
Ms	Mt. Carroll silt loam, benches	120	20.0	80	5.0
Na	Newson loamy sand		10.0	45	2.0
NrC2	Norden silt loam, 6 to 12 percent slopes, eroded	90	15.0	65	4.0
NrD2	Norden silt loam, 12 to 20 percent slopes, eroded	80	14.0	60	3.5
NrE2	Norden silt loam, 20 to 30 percent slopes, eroded				3.0
NtB	Northfield silt loam, 2 to 6 percent slopes	75	8.0	60	3.0
NtC2	Northfield silt loam, 6 to 12 percent slopes, eroded	70	7.0	55	3.0
NtD2	Northfield silt loam, 12 to 20 percent slopes, eroded				3.0
NtE2	Northfield silt loam, 20 to 30 percent slopes, eroded				
NtF	Northfield silt loam, 30 to 45 percent slopes				
On	Orion silt loam [4]	105	17.0	65	4.0
Or	Otter silt loam, overwash [4]				
OsB	Otterholt silt loam, 2 to 6 percent slopes	90	14.5	80	4.0
OsC2	Otterholt silt loam, 6 to 12 percent slopes, eroded	85	14.0	80	4.0
PcB	Pillot silt loam, 2 to 6 percent slopes	90	14.0	80	4.0
PdB	Plainbo loamy sand, 2 to 6 percent slopes	45	7.5	40	2.0
PdC2	Plainbo loamy sand, 6 to 12 percent slopes, eroded	40	7.0	35	1.5
PfB	Plainfield loamy sand, 1 to 6 percent slopes	50	7.5	35	2.0
PfC2	Plainfield loamy sand, 6 to 12 percent slopes, eroded				
PlB	Plainfield loamy sand, loamy substratum, 1 to 6 percent slopes	55	11.0	40	2.5
PlC2	Plainfield loamy sand, loamy substratum, 6 to 12 percent slopes, eroded	50	10.0	35	2.0
Re	Riverwash [3]				
SeB	Seaton silt loam, 2 to 6 percent slopes	100	16.0	70	4.0
SeC2	Seaton silt loam, 6 to 12 percent slopes, eroded	95	15.5	65	4.0
SeD2	Seaton silt loam, 12 to 20 percent slopes, eroded	90	15.0	60	3.5
SeE2	Seaton silt loam, 20 to 30 percent slopes, eroded				3.0
SfB	Seaton silt loam, benches, 2 to 6 percent slopes	110	18.0	80	4.5
SmA	Seaton silt loam, moderately well drained, 0 to 2 percent slopes	120	18.0	70	4.5
SmB	Seaton silt loam, moderately well drained, 2 to 6 percent slopes	120	18.0	70	4.5
So	Shiffer loam	80	13.0	65	3.5
SpB	Sparta loamy sand, 1 to 6 percent slopes	50	8.0	40	2.25
TeA	Tell silt loam, 0 to 2 percent slopes	90	14.0	65	4.0
TeB	Tell silt loam, 2 to 6 percent slopes	85	14.0	65	3.5
Tn	Terrace escarpments, sandy [3]				
TrB	Trempe loamy sand, 1 to 6 percent slopes	50	8.0	40	2.25
UnD2	Urne very fine sandy loam, 12 to 20 percent slopes, eroded				2.7
UnE	Urne very fine sandy loam, 20 to 45 percent slopes				
Vd	Veedum silt loam	80	13.0	60	3.5
Ve	Vesper loam	80	13.0	65	3.5
VlB	Vilas sand, 1 to 6 percent slopes	45	7.5	35	2.0
Wh	Whitehall silt loam, deep variant	120	19.0	75	4.75

[1] Yields are for oats seeded with a grass-legume mixture. Higher yields can be obtained, but a poorer stand of legume-grass seeding usually results.

[2] Yields are for hay cut during the first or second years after the stand is adequately established.

[3] Land types too variable to rate.

[4] Yields are for areas of this soil that are protected from flooding or ponding.

conservation program in Eau Claire County, and they have improved wildlife habitat as well as beautified the landscape. Christmas trees have been produced from some of the plantings.

Woodland suitability groups

The soils of Eau Claire County have been placed in 23 woodland suitability groups to assist owners in planning the use of their soils for woodland. Each group is made up of soils that are suited to the same kinds of trees, that need approximately the same kind of management when the vegetation on them is similar, and that have about the same potential productivity. The map symbol of the soils in each woodland suitability group, the potential productivity, and hazards or limitations that affect management are listed in table 3. The woodland suitability group for each soil can be found either by referring to the "Guide to Mapping Units" at the back of this survey or by referring to the specific soil in the section "Descriptions of the Soils."

Each woodland suitability group is identified by a three part symbol, such as 2o1 or 3r1. The first symbol, a number from 1 to 6, indicates the woodland suitability class and the relative potential tree growth productivity of the soils in the group. The symbol 1

TABLE 3.—*Productivity and soil related limitations by woodland suitability groups*

[Dakota, Pillot, and Whitehall soils (DaA, PcB, and Wh) are not naturally wooded and therefore are not included in this table [1]]

Woodland suitability groups and map symbols	Potential productivity				Species to use for reforestation	Limitations because of—		
	Tree species	Average site index	Number of plots	Yearly growth per acre		Equipment	Erosion	Seedling mortality
				Fbm				
Group 1o1: OsB, OsC2, SeB, SeC2, SfB, SmA, SmB.	Northern red oak.	73	3	270	Red pine, white pine, eastern white pine, white spruce.	Slight	Slight	Slight.
	Sugar maple	66	1	110				
Group 1r1: SeD2, SeE2.	Northern red oak.	71	2	260	Red pine, eastern white pine, white spruce.	Moderate	Moderate	Slight on north and east facing slopes; moderate on south and west facing slopes.
	Sugar maple	66	(2)	110				
Group 2w1: Or	Silver maple	94	1	180	Silver maple, red maple, white ash, green ash.	Severe	Slight	Moderate.
	American elm	---	---	---				
	White ash	---	---	---				
Group 2o1: ArA, AtB, AtC2, GaB, GaC2, HeC2, HkB, HnB, HnC2, MeA, MeB, MeC2, MmA, MrB, MrC2, Ms, NrC2, TeA, TeB.	Northern red oak.	66±7	15	225	Red pine, eastern white pine, white spruce, black spruce, Norway spruce.	Slight	Slight	Slight.
	Sugar maple	60	3	90				
	Yellow birch	61	2	90				
	Bigtooth and quaking aspen.	83±5	4	320				
	Eastern white pine.	58	1	360				
	White ash	---	---	---				
Group 2r1: AtD2, GaD2, GaE, HnD2, NrD2, NrE2.	Northern red oak.	66	(2)	225	Red pine, eastern white pine, white spruce, black spruce, Norway spruce.	Moderate	Moderate	Slight on north and east facing slopes; moderate on south and west facing slopes.
	Sugar maple	60	(2)	90				
	Yellow birch	61	(2)	90				
	Bigtooth and quaking aspen.	83	(2)	320				
	Eastern white pine.	58	(2)	360				
	White ash	---	---	---				
Group 2o2: FoA, FoB, FpB, FpC, KeA.	Northern red oak.	70	1	250	Eastern white pine, red pine, white spruce.	Slight	Slight	Slight.
	White ash	70	(2)	---				
Group 3w2: Cb, La	Red maple	55	(2)	90	Red maple, white ash, white spruce, black spruce.	Severe	Slight	Moderate.
	White ash	55	(2)	---				
	American elm	---	---	---				
Group 3w3 [4]: Ad, Ho, Ma.	Tamarack	48	4	95	Unsuitable for planting.	Severe	Slight	Severe.
	Northern white cedar.	35	1	50				
	Silver maple	92	2	240				
	Red maple	65	1	120				
Group 3d1: BuA, CkB, CkC2, EmB, EmC2, NtB, NtC2.	Black oak [3]	56	2	165	Red pine, white pine, jack pine.	Slight	Slight	Moderate or severe.
	White oak	55	1	165				
Group 3d2: CkD2, EmD2, EmE, NtD2, NtE2.	Black oak [3]	51	4	135	Red pine, white pine, jack pine.	Moderate	Moderate	Moderate or severe.
Group 3d3: NtF	Black oak [3]	43	2	95	Red pine, white pine, jack pine.	Severe	Severe	Severe.

[1] In some cases these soils (DaA, PcB, and Wh) can support an open stand of northern red oak, black oak, white oak, and bur oak. They are highly productive as cropland and therefore are generally farmed.

[2] Estimated.

[3] Data includes northern pin oak.

TABLE 3.—*Productivity and soil related limitations by woodland suitability groups*—Continued

Woodland suitability groups and map symbols	Potential productivity				Species to use for reforestation	Limitations because of—		
	Tree species	Average site index	Number of plots	Yearly growth per acre		Equipment	Erosion	Seedling mortality
				Fbm				
Group 3s1: Ae, BoB, BoC, FrA, GoB, GoC2, GsB, GsC2, LuB, LuC, MdB, MdC, PdB, PdC2, PfB, PfC2, SpB, TrB.	Jack pine	60	3	95	Red pine, eastern white pine, jack pine.	Slight	Slight	Slight.
	Red pine	47	2	195				
	White pine	52	4	250				
	Black oak [3]	49±11	8	125				
Group 3s2: Au, FmA, FmB, Mo.	Quaking aspen	77	1	280	Jack pine, eastern white pine, red pine, white spruce, black spruce, balsam fir.	Slight	Slight	Slight.
	Jack pine	58	3	90				
	Red pine	53	3	250				
	Eastern white pine.	52	1	250				
	White spruce	58	1	400				
	Balsam fir	64	1	400				
Group 3s3: BoE	Jack pine	50	3	60	Red pine, eastern white pine, jack pine.	Moderate	Moderate	Slight on north and east facing slopes; moderate on south and west facing slopes.
	Black oak [3]	46±12	5	110				
Group 3o1: BlB, BlC2, BmA, CeA, DuA, ElB, ElC2, PlB, PlC2.	Jack pine	57	1	85	Red pine, eastern white pine, jack pine.	Slight	Slight	Slight.
	Black oak	51	3	135				
	White oak	----	----	----				
Group 3o2: Cu, De, On, So.	Northern red oak.	55	(2)	160	Red pine, eastern white pine, white spruce.	Slight	Slight	Slight.
	White ash	55	(2)	----				
Group 3r1: BlD2, ElD2, UnD2, UnE.	Jack pine	57	(2)	85	Red pine, eastern white pine, jack pine.	Moderate	Moderate	Slight on north and east facing slopes; moderate on south and west facing slopes.
	Black oak [3]	42	4	90				
Group 4w1: Eo, Na	Jack pine	50	(2)	60	Eastern white pine, jack pine, red maple.	Severe	Slight	Moderate.
	Eastern white pine.	50	1	220				
	Quaking aspen	66	1	200				
	Paper birch	----	----	----				
	Red maple	----	----	----				
Group 4w2: Af, Er, Mc.	Red maple	45	(2)	60	Red maple, silver maple, white ash.	Severe	Slight	Moderate.
	Silver maple	70	(2)	135				
	White ash	----	----	----				
	Quaking aspen	----	----	----				
Group 4s1: VlB	Jack pine	45	(2)	45	Red pine, eastern white pine, jack pine.	Slight	Slight	Severe.
	Red pine	45	(2)	180				
	Black oak [3]	45	(2)	105				
Group 4s2: Tn	Jack pine	45	(2)	45	Red pine, eastern white pine, jack pine.	Moderate	Moderate	Severe.
	Red pine	45	(2)	180				
	Black oak [3]	45	(2)	105				
Group 5w5: Vd, Ve	Black ash	40	(2)	----	Poplar species, willow.	Severe	Slight	Severe.
	Aspen	----	----	----				
	Elm	----	----	----				
	Willow	----	----	----				
Group 6s1 [5]: Re	Brush.							

[4] Trees that grow in soils of this group are generally tamarack, northern white cedar, willows, or elm. Occasionally silver maple, red maple, or white ash becomes established and makes rapid growth.

[5] Trees cannot be expected to reach merchantable size on soils of this nature.

indicates high productivity; 2, moderately high; 3, moderate; 4, moderately low; 5, low; and 6, unproductive.

The woodland suitability classes are based on growth potential (fig. 11) expressed as site index. Site index is defined as the average height of dominant and codominant trees of a given species at 50 years of age. The site indices for some of the more important species and soils have been measured; others are estimated from measurements made on trees of similar species in similar soils.

Site indices used in this report are based on site index curves for upland oak, sugar maple, silver maple, white ash, yellow birch, aspen, eastern white pine, red maple, tamarack, northern white cedar, jack pine, red pine, balsam fir, and black ash (*6, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 24*).

Annual yields for tree species were estimated from yield tables based on the site indices for soft maple, upland oak, spruce, fir, jack pine, red pine, white pine, aspen, and sugar maple (*3, 9, 10, 20, 22, 23, 24*).

The standard deviation is shown as a plus or minus figure for each species for which sufficient numbers or plots have been measured to justify calculation of the standard deviation, generally more than four plots.

***Figure 11.*—Forester boring a red oak growing in a Seaton soil. By examining core he can determine the age and rate of growth.**

Yields for other species were estimated from one of the preceding references for a similar species.

The second part of the symbol identifying a woodland suitability group is a small letter. This letter indicates the subclass and an important soil property that imposes a slight to severe limitation in managing the soils of the group for wood crops. The following are definitions of the subclasses:

Subclass w (excessive wetness).—Soils that have significant limitations for woodland use or management because of excess water, either seasonally or year around. These soils have restricted drainage, a high water table, or an overflow hazard that adversely affects either stand development or management.

Subclass d (restricted rooting depth).—Soils that have restrictions or limitations for woodland use or management because of a restricted rooting depth. Examples are soils that are shallow to hard rock or soils that have a hardpan or other layers that restrict roots at shallow depths.

Subclass c (clayey soils).—Soils that have restrictions or limitations for woodland use or management because of the kind or amount of clay in the upper part of the soil.

Subclass s (sandy soils).—Soils that have moderate to severe restrictions or limitations for woodland use or management because they are dry and sandy and have little or no textural B horizon. These soils impose equipment limitations, have low available water capacity, and normally are low in available plant nutrients.

Subclass f (fragmental or skeletal soils).—Soils that have restrictions or limitations for woodland use or management because of large amounts of coarse fragments in the profile. These fragments are generally more than 2 millimeters and less than 10 inches in diameter. Flaggy soils are included.

Subclass r (relief or slope steepness).—Soils that have restrictions or limitations for woodland use or management only because of steepness of slope.

Subclass o (slight or no limitations).—Soils that have no significant restrictions or limitations for woodland use or management.

The third part of the symbol, a number, identifies the woodland suitability *group*. All soils in a group have a similar level of productivity and have the same soil related hazards to woodland management.

The hazards or limitations that affect management of soils for woodland in Eau Claire County are the limitation to use of equipment, the hazard of erosion, and the hazard of seedling mortality. Table 3 gives ratings for these hazards or limitations for each woodland suitability group. These ratings are *slight, moderate,* or *severe.*

Equipment limitations are rated on the basis of soil characteristics that restrict or prohibit the use of equipment commonly used in tending and harvesting the trees. In Eau Claire County the soil characteristics having the most limiting effect are excessive soil wetness, slope, and texture of the surface layer. *Slight*

means there is no restriction in the kind of equipment or in the time of year it is used; *moderate* means that use of equipment is restricted for less than 3 months of the year; and *severe* means that special equipment is needed and its use is restricted for more than 3 months of the year.

The erosion hazard refers to the potential hazard of soil losses in woodland. The hazard is *slight* if expected soil losses are small; *moderate* if some soil losses are expected and care is needed during logging and construction to reduce soil losses; *severe* if special methods of operation are necessary for preventing excessive soil losses,

Seedling mortality refers to the expected degree of mortality of planted seedlings as influenced by kinds of soil. Considered in the ratings are excessive soil wetness, hazard of flooding, slope and aspect, texture, structure, and plant competition. Normal rainfall, good planting stock, and proper planting are assumed. A rating of *slight* indicates an expected loss of less than 25 percent of the planted seedlings; *moderate,* a loss of 25 to 50 percent of the seedlings; and *severe,* a loss of more than 50 percent of the seedlings.

Landscaping and windbreak planting selection guide

This section provides information on trees, shrubs, and vines used in landscaping sites for homes, schools, industry, and recreation. It also provides information on species that are suitable for use as windbreaks around farmsteads or open fields.

A significant acreage in Eau Claire County is subject to soil blowing. Sandy and loamy soils of the Billet, Burkhardt, Chetek, Gotham, Plainfield, and Sparta series need the protection of windbreaks and need careful cropping to minimize soil losses caused by blowing. Eau Claire County farmers have been planting tree windbreaks, generally of native pines, since the 1930's.

Soil Conservation Service employees in Madison, Wisconsin, have measured the height growth of pine windbreaks on several of the important soil series—mostly on Plainfield and Sparta soils. At present this information is unpublished, but generally red pine on Plainfield soils is 33 feet to 45 feet tall at 25 years of age and heights of white pine are similar. On Sparta soils red pine were 33 feet to 40 feet tall at 25 years of age, while white pine were 35 feet to 42 feet tall and jack pine were 36 feet to 40 feet tall at the same age. Growth of these species on Billett, Burkhardt, Chetek, and Gotham soils was found to be similar on the basis of limited measurements.

Trees and shrubs of different species range widely in their suitability to different soils and to site conditions. The soils in the county have been placed in four tree and shrub selection groups, mainly on the basis of the degree and length of time that soil is saturated with water and on the available water capacity. Each of the soils in a specific group has similar suitability for trees, shrubs, and vines.

A brief general description of the soils in each tree and shrub group and the map symbols of these soils are listed in tables 4 and 5. The tree and shrub group for each soil can also be found by referring to the "Guide to Mapping Units" at the back of this survey.

Presented in table 4 are trees suitable for specified uses and information on growth form and height at maturity. In table 5 shrubs and vines suitable for specific uses are listed and information on uses, growth form, and asthetic value are presented. The list of plants in these tables is a partial one designed to indicate certain plants suited to soils in the county. Many of the plants are suitable for both landscaping and food and cover for wildlife.

Use of the Soils for Wildlife Habitat[4]

The soils of Eau Claire County have a wide range in physical and chemical characteristics affecting the kind and amount of vegetation and wildlife they will support. Research has shown a direct relationship between soil fertility and the quantity and health of the wildlife.

Food and cover planting on lands used primarily or secondarily for wildlife production encourage wildlife. Wildlife benefit from such soil and water conservation practices as stripcropping, fertilization, and tree planting in areas used for pasture, woodland, and other purposes.

Most of the major soils are suitable for intensive farming and have a high potential for wildlife, but because of other uses, there is little wildlife habitat.

For wildlife interpretive purposes, the soils in Eau Claire County have been placed in 9 of the 10 groups of a statewide system of grouping and identification. Soils in group 2 are not in this county. The soils in each group are briefly described in table 6. The soils in these groups differ in internal drainage, texture, thickness of solum, water holding capacity, or flooding hazard. Wetland groups 6, 7, and 8, consisting of somewhat poorly drained to very poorly drained soils, land types, and organic soils, contain the most important soils for a wide variety of wildlife in the county (fig. 12).

In table 6 the wildlife groups of soils in Eau Claire County are rated for their suitability to produce various elements of wildlife habitat. Elements are grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood trees and shrubs, coniferous trees, wetland plants for food and cover, and shallow and deep water developments.

Grain and seed crops include corn, oats, sorghums, wheat, barley, rye, soybeans and other grain crops that are used for food and cover for wildlife.

Grasses and legumes include such grasses as switchgrass, bromegrass, timothy, and fescue and such legumes as alfalfa, red clover, sweet clover, and vetch that are used by wildlife for food and cover.

Wild herbaceous upland plants include native or introduced grasses, legumes, and forbs that provide food and cover for upland wildlife and are mainly established by natural means. Plants such as bluegrass, roundhead lespedeza, beggartick, aster, and goldenrod are important in this group.

Woody plants include shrubs, hardwood trees, and coniferous trees. Shrubs are low growing woody plants (including conifers less than 8 feet tall) that

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TABLE 4.—*Landscape and windbreak planting*

[The letters in parentheses following each species name have special significance: the first letter gives the general height of the tree, with "L" for columnar, "O" for oval, "P" for pyramidal,

Tree and shrub group and map symbol	Trees or shrubs suitable for—	
	Shade	Streets
SUNNY SITES		
Group 1: Moderately deep and deep, moderately well drained to somewhat excessively drained, medium textured soils that have moderate to very high available water capacity: ArA, DaA, FpB, FpC, GaB, GaC2, GaD2, GaE, HeC2, HkB (Hiles part only), MmA, MrB, MrC2, Ms, NrC2, NrD2, NrE2, OsB, OsC2, PcB, SeB, SeC2, SeD2, SeE2, SfB, SmA, SmB, TeA, TeB, UnD2, UnE, Wh.	American beech (LO), sugar maple (LO), red maple (MO), red oak (LR), white oak (LR), basswood (LO), hackberry (MR), white ash (LO), sycamore (LO), bur oak (LR), Norway maple (MR), silver maple (LO), thornless honeylocust (MO).	Norway maple (MR), southern pin oak (MP), thornless honeylocust (MO), basswood (LO), white ash (LO), sugar maple (LO), hackberry (MR), red maple (MO).
Group 2: Moderately well drained to excessively drained, coarse textured to moderately coarse textured soils, or shallow soils with moderate to very low available water capacity: Ae, AtB, AtC2, AtD2, BIB, BIC2, BID2, BmA, BoB, BoC, BoE, BuA, CeA, CkB, EmB, EmC2, EmD2, EmE, FrA, GoB, GoC2, GsB, GsC2, LuB, LuC, MdB, MdC, NtB, NtC2, NtD2, NtE2, NtF, PdB, PdC2, PfB, PfC2, PIB, PIC2, Re, SpB, Tn, TrB, VIB.	Bur oak (LR), hackberry (MR), black oak (LR), silver maple (LO), green ash (MO), thornless honeylocust (MO).	Green ash (MO), white ash (LO), hackberry (MR), thornless honeylocust (MO).
Group 3: Somewhat poorly drained to very poorly drained mineral soils: Af, Au, Cb, Cu, De, Eo, Er, FmA, FmB, FoA, FoB, HkB (Kert part only), KeA, La, Mc, Mo, Na, On, Or, So, Vd, Ve.	Swamp white oak (LR), hackberry (MR), red maple (MO), basswood (LO), green ash (MO), white ash (LO), silver maple (LO), cottonwood (LO).	Green ash (MO), basswood (LO), red maple (MO).
Group 4: Very poorly drained organic soils: Ad, Ho, Ma.	Silver maple (LO), red maple (MO)	Red maple (MO), laurel willow (MO)
PARTLY SHADED SITES		
Group 1: Moderately deep and deep, moderately well drained to somewhat excessively drained, medium textured soils that have moderate to very high available water capacity: ArA, DaA, FpB, FpC, GaB, GaC2, GaD2, GaE, HeC2, HkB (Hiles part only), HnB, HnC2, HnD2, MeA, MeB, MeC2, MmA, MrB, MrC2, Ms, NrC2, NrD2, NrE2, OsB, OsC2, PcB, SeB, SeC2, SeD2, SeE2, SfB, SmA, SmB, TeA, TeB, UnD2, UnE, Wh.	American beech (LO), sugar maple (LO), red maple (MO), red oak (LR), hackberry (MR), white ash (LO), basswood (LO).	Norway maple (MP), white ash (LO), basswood (LO), sugar maple (LO).
Group 2: Moderately well drained to excessively drained, coarse textured to moderately coarse textured soils, or shallow soils with moderate to very low available water capacity: Ae, AtB, AtC2, AtD2, BIB, BIC2, BID2, BmA, BoB, BoC, BoE, BuA, CeA, CkB, CkC2, CkD2, DuA, EIB, EIC2, EID2, EmB, EmC2, EmD2, EmE, FrA, GoB, GoC2, GsB, GsC2, LuB, LuC, MdB, MdC, NtB, NtC2, NtD2, NtE2, NtF, PdB, PdC2, PfB, PfC2, PIB, PIC2, Re, SpB, Tn, TrB, VIB.	Hackberry (MR)	Hackberry (MR)
Group 3: Somewhat poorly drained to very poorly drained mineral soils: Af, Au, Cb, Cu, De, Eo, Er, FmA, FmB, FoA, FoB, HkB (Kert part only), KeA, La, Mc, Mo, Na, On, Or, So, Vd, Ve.	Swamp white oak (LR), hackberry (MR), red maple (MO), basswood (LO), green ash (MO), white ash (LO).	Green ash (MO), basswood (LO), red maple (MO).
Group 4: Very poorly drained organic soils: Ad, Ho, Ma.	Red maple (MO)	None

and selection guide by tree and shrub group

indicating higher than 60 feet, "M" indicating 30 to 60 feet, and "S" less than 30 feet; the second letter gives the shape, with "C" standing "Q" for pendulous, and "R" for round]

Trees or shrubs suitable for—Continued		
Lawns	Hedges and screens	Windbreaks
SUNNY SITES—Continued		
Flowering crabapple (SR), mountainash (SO), blue beech (SR), paper birch (MO), river birch (MO), Russian-olive (SR), southern pin oak (MP), serviceberry (SR), horse chestnut (LR), Norway spruce (LP), red pine (LP), white pine (LP), white spruce (MP), black cherry (LO), blue spruce (LP), hawthorn (SR).	Redcedar (SP), white-cedar (MC, P), white pine (LP), white spruce (MP), Lombardy poplar (LC), Russian-olive (SR), upright yew (SP).	White spruce (MP), white-cedar (MC, P), white pine (LP), red pine (LP), Norway spruce (LP).
Flowering crabapple (SR), paper birch (MO), redcedar (SP), white pine (LP), white spruce (MP), red pine (LP), Russian-olive (SR).	Redcedar (SP), Russian-olive (SR), red pine (LP), white pine (LP), upright yew (SP), white spruce (MP).	Red pine (LP), white pine (LP), redcedar (SP).
White spruce (MP), paper birch (MO), mountainash (SO), weeping willow (MQ), white-cedar (MP), river birch (MO).	White-cedar (MC), white spruce (MP), lombardy poplar (LC), laurel willow (MO).	White-cedar (MC), white spruce (MP), white pine (LP).
White-cedar (MC), white spruce (MP), weeping willow (MQ).	White-cedar (MC), laurel willow (MO)------	Laurel willow (MO), poplar selections (LP), tree lilac (SO), white-cedar (MC).
PARTLY SHADED SITES—Continued		
Blue beech (SP), serviceberry (SR), white pine (LP), white spruce (MP), blue spruce (LP), Norway spruce (LP).	White-cedar (MC), white pine (LP), white spruce (MP), upright yew (SP).	White-cedar (MC, P), white pine (LP), white spruce (MP).
White pine (LP), white spruce (MP)-------	Upright yew (SP), white pine (LP), white spruce (MP).	White pine (LP).
White spruce (MP), mountainash (SO)------	White-cedar (MC), white spruce (MP)------	White-cedar (MC), white spruce (MP).
White-cedar (MC), white spruce (MP)------	White-cedar (MC)----------	White-cedar (MC).

TABLE 5.—*Shrubs and vines suited to the soils*

[The letter "X" indicates that the plant is suited to the use shown in the column heading]

Tree and shrub group and map symbols	Common name	Type of plant	Potential height	Suitable for—				
				Landscaping	Hedge, screen, and windbreak	Wildlife food and cover	Roadside planting	Ground cover
			Feet					
Group 1: Moderately deep and deep, moderately well drained to somewhat excessively drained, medium textured soils that have moderate to high available water capacity: ArA, DaA, FpB, FpC, GaB, GaC2, GaD2, GaE, HeC2, HkB (Hiles part only), HnB, HnC2, HnD2, MeA, MeB, MeC2, MmA, MrB, MrC2, Ms, NrC2, NrD2, NrE2, OsB, OsC2, PcB, SeB, SeC2, SeD2, SeE2, SfB, SmA, SmB, TeA, TeB, UnD2, UnE, Wh.	Arborvitae (shrub type)	Shrub	3–7	X	X	X		
	Autumn-olive	Shrub	10–15	X	X	X		
	Barberry, Japanese	Shrub	6	X	X	X		
	Bittersweet	Vine		X		X	X	X
	Blackberry, dewberry, blackcap raspberry.	Bramble	1–5			X	X	X
	Chokeberry, black	Shrub	1–3	X		X	X	X
	Cotoneaster	Shrub	4–8	X	X	X		
	Crabapple	Shrub	10–25	X	X	X	X	
	Currant, alpine	Shrub	6–7	X	X			
	Dogwood, gray	Shrub	6–10			X	X	
	Dogwood, pagoda	Shrub	10–15			X	X	
	Dogwood, redosier	Shrub	3–9					
	Dogwood, roundleaf	Shrub	3–9			X	X	X
	Dogwood, silky	Shrub	6–10		X	X	X	
	Elder, American	Shrub	3–10			X	X	X
	Filbert (hazelnut)	Shrub	5–8			X	X	
	Forsythia	Shrub	4–8	X				
	Grape, wild	Vine				X	X	X
	Hawthorn or thornapple	Shrub	5–15			X	X	
	Honeysuckle (shrub types).	Shrub	6–12	X	X	X		
	Juniper, creeping	Shrub	1–2	X		X	X	X
	Juniper, Pfitzer	Shrub	8–10	X		X		
	Lilac	Shrub	8–10	X	X		X	
	Maple, Amur	Shrub	1	X	X			
	Mockorange	Shrub	6–9	X	X			
	Myrtle or periwinkle	Vine	1	X			X	X
	Ninebark, common	Shrub	6–9	X	X		X	
	Peashrub, Siberian	Shrub	10–15		X	X	X	
	Pine, mugho	Shrub	6–9	X		X		
	Plum, American	Shrub	10–15			X	X	
	Privet, Amur	Shrub	10		X	X		
	Privet, Regels border	Shrub	6–9		X	X		
	Redcedar, eastern	Shrub	6–9		X	X	X	
	Rose, rugosa and horticultural varieties.	Shrub	2–6	X		X	X	
	Russian-olive	Shrub	15+	X	X	X		
	Snowberry	Shrub	3–4	X		X	X	X
	Spirea, Anthony Waterer	Shrub	2–3	X				
	Spirea, Vanhoutte	Shrub	5–6	X	X			
	Sumac, fragrant	Shrub	3	X		X	X	X
	Sumac, smooth	Shrub	6–10			X	X	
	Sumac, staghorn	Shrub	10–15			X	X	
	Viburnum, American cranberry bush.	Shrub	7–9	X	X	X	X	
	Viburnum, arrowwood	Shrub	10–12	X	X	X		
	Viburnum, blackhaw	Shrub	8–10		X	X	X	
	Viburnum, mapleleaf	Shrub	3–5			X	X	
	Viburnum, nannyberry	Shrub	9–12		X	X	X	
	Viburnum, Rafinesque	Shrub	2–4			X	X	
	Viburnum, wayfaringtree	Shrub	4–9	X		X	X	
	Virginia creeper	Vine				X	X	X
	Wahoo, eastern	Shrub	4–9	X		X	X	
	Weigela	Shrub	4–8	X	X			
	Willows, shrubby types including pussywillow.	Shrub	2–8	X	X	X	X	
	Winterberry, common	Shrub	6–9			X	X	
	Yew, shrub type	Shrub	3–10	X		X		

TABLE 5.—*Shrubs and vines suited to the soils*—Continued

Tree and shrub group and map symbols	Common name	Type of plant	Potential height	Suitable for—				
				Landscaping	Hedge, screen, and windbreak	Wildlife food and cover	Roadside planting	Ground cover
			Feet					
Group 2:	Arborvitae (shrub type)	Shrub	3–7	X	X	X		
Moderately well drained to excessively drained, coarse textured, moderately coarse textured, or shallow soils that have moderate to very low available water capacity:	Autumn-olive	Shrub	10–15	X	X	X		
	Barberry, Japanese	Shrub	6	X	X	X		
	Bayberry or waxmyrtle	Shrub	5–9	X		X		X
	Bittersweet	Vine		X		X	X	X
	Blackberry, dewberry, blackcap raspberry.	Bramble	1–5			X	X	X
	Chokeberry, black	Shrub	1–3	X		X	X	X
	Cotoneaster	Shrub	4–8	X	X	X		
	Crabapple	Shrub	10–25	X	X	X	X	
	Currant, alpine	Shrub	6–7	X	X			
	Dogwood, gray	Shrub	6–10			X	X	
	Filbert (hazelnut)	Shrub	5–8			X	X	
	Forsythia	Shrub	4–8	X				
	Grape, wild	Vine				X	X	X
	Hawthorn or thornapple	Shrub	5–15			X	X	
	Honeysuckle (shrub type).	Shrub	6–12	X	X	X		
	Juniper, creeping	Shrub	1–2	X		X	X	X
	Juniper, Pfitzer	Shrub	8–10	X		X		
	Lilac	Shrub	8–10	X	X		X	
	Maple, Amur	Shrub	1	X	X			
	Mockorange	Shrub	6–9	X	X			
	Myrtle or periwinkle	Vine	1	X			X	X
	Ninebark, common	Shrub	6–9	X	X		X	
	Peashrub, Siberian	Shrub	10–15		X	X	X	
	Pine, mugho	Shrub	6–9	X		X		
	Plum, American	Shrub	10–15			X	X	
	Privet, Amur	Shrub	10		X	X		
	Privet, Regels border	Shrub	6–9		X	X		
	Redcedar, eastern	Shrub	6–9		X	X	X	
	Russian-olive	Shrub	15+	X	X	X		
	Snowberry	Shrub	3–4	X		X	X	X
	Spirea, Anthony Waterer	Shrub	2–3	X				
	Spirea, Vanhoutte	Shrub	5–6	X	X			
	Sumac, fragrant	Shrub	3	X		X	X	X
	Sumac, smooth	Shrub	6–10			X	X	
	Sumac, staghorn	Shrub	10–15			X	X	
	Viburnum, blackhaw	Shrub	8–10		X	X	X	
	Viburnum, nannyberry	Shrub	9–12		X	X	X	
	Viburnum, Rafinesque	Shrub	2–4			X	X	
	Viburnum, wayfaringtree	Shrub	4–9	X		X	X	
	Virginia creeper	Vine				X	X	X
	Willows, shrubby types including pussywillow.	Shrub	2–8	X	X	X	X	

furnish fruit, seeds, browse, and cover for wildlife. Examples are viburnum, dogwood, and hazelnut. Hardwood trees such as oak, maple, cherry, and nut trees furnish mast, fruit, seeds, dens, cover, and browse for wildlife. Coniferous trees (more than eight feet tall) such as pine, fir, spruce, tamarack, and cedar furnish seeds, fruit, browse, and cover for wildlife.

Wetland plants for food and cover include forbs, grasses, sedges, aquatic plants, and woody plants that grow well in wet areas. They furnish fruit, seeds, browse, and cover for wildlife that live in wet areas and on or near open water. Examples are smartweed, canarygrass, sedges, arrowhead, alder, and willow. These plants grow well in types 1, 2, and 6 wetlands, as defined in U.S. Department of Interior Circular 39 (*25*). Type 1 wetlands are seasonally flooded basins and nearly level areas that are covered or saturated with water during seasonal wet periods, but are generally relatively dry during much of the growing season. Type 2 wetlands include fresh meadows that are generally not covered by water during the growing season, but are saturated within a few inches of the soil surface. Type 6 wetlands consist of shrub swamp areas in which the soil is generally saturated during the growing season.

Shallow water developments are less than 5 feet deep and include natural and artificial water areas formed by dug out areas or low embankments or both. Common plants are cattails, bulrushes, sedges, and

TABLE 5.—*Shrubs and vines suited to the soils*—Continued

Tree and shrub group and map symbols	Common name	Type of plant	Potential height	Suitable for—				
				Landscaping	Hedge, screen, and windbreak	Wildlife food and cover	Roadside planting	Ground cover
			Feet					
Group 3: Somewhat poorly drained to very poorly drained mineral soils: Af, Au, Cb, Cu, De, Eo, Er, FmA, FmB, FoA, FoB, HkB, (Kert part only), KeA, La, Mc, Mo, Na, On, Or, So, Vd, Ve.	Arborvitae (shrub type)	Shrub	3–7	X	X	X		
	Autumn-olive	Shrub	10–15	X	X	X		
	Bayberry or waxmyrtle	Shrub	5–9	X		X		X
	Dogwood, gray	Shrub	6–10			X	X	
	Dogwood, pagoda	Shrub	10–15			X	X	
	Dogwood, redosier	Shrub	3–9					
	Dogwood, roundleaf	Shrub	3–9			X	X	X
	Dogwood, silky	Shrub	6–10		X	X	X	
	Elder, American	Shrub	3–10			X	X	X
	Hawthorn or thornapple	Shrub	5–15			X	X	
	Honeysuckle (shrub types).	Shrub	6–12	X	X	X		
	Ninebark, common	Shrub	6–9	X	X		X	
	Plum, American	Shrub	10–15			X	X	
	Russian-olive	Shrub	15+	X	X	X		
	Spirea, narrowleaf	Shrub	3–4				X	
	Spirea, Vanhoutte	Shrub	5–6	X	X			
	Viburnum, American cranberrybush.	Shrub	7–9	X	X	X	X	
	Viburnum, mapleleaf	Shrub	3–5			X	X	
	Viburnum, nannyberry	Shrub	9–12		X	X	X	
	Viburnum, wayfaringtree	Shrub	4–9	X		X	X	
	Willows, shrubby types including pussywillow.	Shrub	2–8	X	X	X	X	
	Winterberry, common	Shrub	6–9			X	X	
Group 4: Very poorly drained organic soils: Ad, Ho, Ma.	Arborvitae (shrub type)	Shrub	3–7	X	X	X		
	Dogwood, redosier	Shrub	3–9					
	Dogwood, roundleaf	Shrub	3–9			X	X	X
	Dogwood, silky	Shrub	6–10		X	X	X	
	Elder, American	Shrub	3–10			X	X	X
	Honeysuckle (shrub types).	Shrub	6–12	X	X	X		
	Ninebark, common	Shrub	6–9	X	X		X	
	Spirea, narrowleaf	Shrub	3–4				X	
	Viburnum, American cranberrybush.	Shrub	7–9	X	X	X	X	
	Viburnum, mapleleaf	Shrub	3–5			X	X	
	Viburnum, nannyberry	Shrub	9–12		X	X	X	
	Viburnum, wayfaringtree	Shrub	4–9	X		X	X	
	Willows, shrubby types including pussywillow.	Shrub	2–8	X	X	X	X	
	Winterberry, common	Shrub	6–9			X	X	

reeds. These are types 3 to 4 wetlands, as defined by the U.S. Department of Interior. Type 3 wetlands consist of shallow marshes in which the soil is saturated or covered with as much as 6 inches of water during the growing season. Type 4 wetlands are deep marshes that are covered by 6 inches to about 3 feet of water during the growing season.

Deep water developments are more than five feet deep and consist of natural water areas, artificial water areas, or water areas formed by dug out areas or embankments or both. Common plants are coontail, waterlily, milfoil, and waterweed. The deep water areas consist of ponds, lakes, and type 5 wetlands, as defined by the U.S. Department of Interior. Type 5 wetlands are open, freshwater areas that include shallow ponds and reservoirs or wet areas where water is less than 10 feet deep.

About 94,680 acres of Eau Claire County are wet soils that have a permanent or seasonal high water table or are subject to flooding. In 1937 type 2 wetlands made up 7,184 acres of Eau Claire County, and in 1967 they made up only 4,812 acres. Types 3 and 5 wetlands made up 700 acres in 1937 and 583 acres in 1967. Type 6 wetlands also decreased—from 12,861 acres in 1937 to 11,000 acres in 1966. Type 7 wetlands increased from 4,959 acres in 1937 to 5,000 acres in 1967. The total acreage of wetlands in the county was 25,704 in 1937 and 21,395 acres in 1967.

The 1967 survey figure of 21,395 acres of wetlands indicates that about 22 percent of the original wet-

lands are left in their natural condition in the county. This has had an effect upon the species of wildlife remaining in the county.

Table 7 contains lists of the important kinds of wildlife in Eau Claire County and rates the importance of the various habitat elements for the stated kind of wildlife.

Using tables 6 and 7, the suitability of a particular soil for a given species of wildife can be determined. For example, critical parts of the habitat for ring-necked pheasants are grass and legumes, wild herbaceous upland plants, and herbaceous wetland plants. Only a combination of soils from different groups would be well suited for all of these habitat elements. An environment containing soils in Group 1, loamy, well drained soils, and Group 8, organic soils, would be desirable.

Use of the Soils for Recreational Development

About 20 percent of the acreage of Eau Claire County is used mainly for recreation. The largest area is a predominantly wooded area in the eastern part of the county. It consists of about 70,000 acres of mostly county owned land used for hunting, snowmobiling, and hiking. Tributaries of the Eau Claire River flow through the area, providing canoeing and fishing. Also, a number of lakes that can be used for boating, fishing, and water skiing are in the county. These include Half Moon Lake in the city of Eau Claire and Lake Altoona, Dells Pond, Lake Eau Claire, and Coon Fork Lake. Harstad Park on the Eau Claire River and Coon Fork Lake Park in the eastern wooded area are public camping and picnicking spots.

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 8 the soils of Eau Claire County are rated according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, paths and trails, and golf course fairways.

The soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can be easily overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used mainly for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not duty when dry, are free of flooding during the season of use, and do not have slopes or stoniness that greatly increase the cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and other organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 12 percent, and have few or no rocks or stones on the surface.

The ratings for golf course fairways are based only on those features that affect the use of soils for fairways. Greens, traps and other hazards, and tees are generally manmade from transported soil material and are not considered in establishing the ratings given in the table. Soils used for golf course fairways should be well drained, firm, and gently undulating. They should be free of flooding during the season of use, have good trafficability, and be relatively free of coarse fragments. They should be capable of supporting a good turf and be well suited to many kinds of trees and shrubs. Loamy soils are well suited, but coarser textured soils are also suitable if they are irrigated. Associated poorly drained mineral and organic soils can be used for pond sites or for storing water for turf maintenance. Likewise, associated sandy soils can be used for traps or as a source of sand for greens.

Engineering Uses of the Soils[5]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the soil properties highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

[5] STANLEY O. DINGLE, civil engineer, Soil Conservation Service, helped prepare this section.

TABLE 6.—*Soil interpretations*

Wildlife groups and map symbols	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants
Group 1: Dominantly moderately well drained to somewhat excessively drained soils that are loamy throughout and are not subject to flooding: AtB, AtC2, AtD2, BlB, BlC2, BlD2, BmA, DuA, ElB, ElC2, ElD2, FpB, FpC, GaB, GaC2, GaD2, GaE, HeC2, HkB, HnB, HnC2, HnD2, LuB, LuC, MeA, MeB, MeC2, MmA, MrB, MrC2, Ms, NrC2, NrD2, NrE2, OsB, OsC2, SeB, SeC2, SeD2, SeE2, SfB, SmA, SmB, TeA, TeB, UnD2, UnE.	Good if slopes are 0 to 6 percent; fair if slopes are 6 to 12 percent; poor if slopes are more than 12 percent; hazard of water erosion.	Good if slopes are 0 to 12 percent; fair if slopes are 12 to 20 percent; poor if slopes are more than 20 percent.	Good if slopes are 0 to 20 percent; fair if slopes are more than 20 percent.
Group 3: Moderately well drained to excessively drained soils and land types that are sandy throughout: Ae, BoB, BoC, BoE, FrA, GoB, GoC2, GsB, GsC2, MdB, MdC, PdB, PdC2, PfB, PfC2, PlB, PlC2, SpB, Tn, TrB, VlB.	Fair: hazard of water erosion and soil blowing; low available water capacity.	Fair	Fair
Group 4: Somewhat excessively drained to well drained soils that have shallow rooting depth: BuA, CkB, CkC2, CkD2, EmB, EmC2, EmD2, EmE, NtB, NtC2, NtD2, NtE2, NtF.	Fair if slopes are 0 to 6 percent; poor if slopes are more than 6 percent; hazard of water erosion.	Good if slopes are 0 to 12 percent; fair if slopes are 12 to 20 percent; poor if slopes are more than 20 percent.	Good if slopes are 0 to 20 percent; fair if slopes are more than 20 percent.
Group 5: Well drained loamy soils that have a thick, dark colored surface layer: DaA, PcB, Wh.	Good	Good	Good
Group 6: Somewhat poorly drained soils: Au, Cu, De, FmA, FmB, FoA, FoB, HkB, KeA, Mo, On, So.	Good where soil has been drained; fair where soil is undrained and wet.	Good where soil has been drained; fair where soil is undrained and wet; few species suited.	Fair: wet soil; some species not suited.
Group 7: Poorly and very poorly drained soils and land types: Af, Cb, Eo, Er, La, Mc, Na, Or, Vd, Ve.	Good where soil has been drained; unsuitable where soil is undrained and wet.	Fair where soil has been drained; poor where soil is undrained and wet.	Unsuitable; very wet soil; few species suited.
Group 8: Organic soils: Ad, Ho, Ma.	Fair where soil has been drained; unsuitable where soil is undrained and wet.	Fair where soil has been drained; unsuitable where soil is undrained and wet; few species suited.	Unsuitable; wet soil; few species suited.
Group 9: Well and moderately well drained soils that are subject to flooding: ArA, CeA.	Good	Good	Good
Group 10: Thin, droughty land type: Re.	Unsuitable: sandy and droughty; will not support vegetation; subject to flooding.	Unsuitable	Unsuitable

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built to predict the performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

for elements of wildlife habitat

Woody plants		Wetland plants for food and cover	Shallow and deep water developments
Hardwood trees and shrubs	Coniferous trees		
Good if slopes are 0 to 20 percent; fair if slopes are more than 20 percent.	Good if slopes are 0 to 20 percent; fair if slopes are more than 20 percent.	Poor if slopes are 0 to 2 percent; unsuitable if slopes are more than 2 percent; few species suited.	Poor if slopes are 0 to 2 percent; unsuitable if slopes are more than 2 percent; moderate permeability.
Fair	Good	Poor if slopes are 0 to 2 percent; unsuitable if slopes are more than 2 percent; few species suited.	Unsuitable: shallow to very porous substratum.
Good if slopes are 0 to 20 percent; fair if slopes are more than 20 percent.	Good if slopes are 0 to 20 percent; fair if slopes are more than 20 percent; few species suited.	Poor if slopes are 0 to 2 percent; unsuitable if slopes are more than 2 percent.	Unsuitable: shallow to very porous substratum.
Fair	Fair: grass competition	Unsuitable	Unsuitable.
Fair: wet soil; some species not suited.	Fair: wet soil; some species not suited.	Good	Good if slopes are 0 to 2 percent; fair if slopes are more than 2 percent; wet soil; moderately rapid or rapid permeability in some soils in the group.
Poor: very wet soil; few species suited.	Poor: very wet soil; few species suited.	Good	Good.
Poor: wet soil; few species suited.	Fair: wet soil; some species not suited.	Good	Good if slopes are 0 to 2 percent; fair if slopes are more than 2 percent; wet soil.
Fair: hazard of flooding	Fair: hazard of flooding; some species not suited.	Poor: few species suited	Poor if slopes are 0 to 2 percent; unsuitable if slopes are more than 2 percent; moderate permeability.
Unsuitable	Poor: few species suited; very low available water capacity.	Unsuitable: very low available water capacity; insufficient soil moisture.	Unsuitable: sand or gravel.

Most of the information in this section is presented in tables 9, 10 and 11, which show, respectively, several estimated soil properties significant to engineering, interpretations for various engineering uses, and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 9 and 10, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavations to a depth greater than those shown in the tables, generally a depth more than 5 feet. Also, inspection of sites, especially small ones, is needed because many delineated areas of a given mapping unit may contain small areas of other kinds of soils that have strongly contrasting properties and different suitabilities or limitations for engineering.

Figure 12.—**Ditches dug in Markey muck for muskrat habitat.**

Some of the terms used in this soil survey have special meanings to soil scientists that may be unfamiliar to engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying soils for engineering are the Unified system used by the SCS engineers, Department of Defense, and others, and the AASHTO system adopted by the American Association of State Highway (and Transportation) Officials.

The Unified system is used to classify soils according to engineering uses for building material or for the support of structures other than highways. Soils are classified according to particle size distribution, plasticity index, liquid limit, and organic matter content (*2*). Soils are grouped into 15 classes. Eight classes are coarse grained soils that are subdivided on the basis of gravel and sand content and identified as GW, GP, GM, GC, SW, SP, SM, and SC. Six classes are fine grained soils and are subdivided on the basis of the plasticity index. Nonplastic classes are ML, MH, OL, and OH; plastic classes are CL and CH. One class of highly organic soils is identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example CL–ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance (*1*). In this system a soil is placed in one of seven basic groups, ranging from A–1 through A–7, on the basis of grain size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils that have high bearing strength and are the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement the engineering value of a soil material can be indicated by a group index number. Group indices range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils with group index numbers in parentheses, is shown in table 11; the estimated classification, without group index numbers, is given in table 9 for all soils mapped in the survey area.

Estimated soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 9. These estimates are made for representative soil profiles by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. The following are explanations of some of the columns in table 9:

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 9 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic. If the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic; and the liquid limit, from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 9, but in table 11 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis

TABLE 7.—*Importance of elements of wildlife habitat for selected kinds of wildlife*

[Habitat elements are rated: 1, of little or no value; 2, of some value; 3, important; 4, very important; 5, of key or critical necessity for survival. Absence of a figure in a column indicates element is not applicable]

Selected wildlife species	Grain and seed crops		Grasses and legumes		Wild herbaceous upland plants	Woody plants			Wetland plants for food and cover	Shallow water	Deep water
						Hardwood		Coniferous trees			
	Harvested	Unharvested	Harvested	Unharvested		Shrubs	Trees				
Migratory waterfowl:											
Ducks	3	3	1	3	3		1		5	5	4
Geese	4	5	4	1					2	3	3
Upland game birds:											
Hungarian partridge	4	4	3	4	4	1			1		
Pheasant	4	4		5	5	4		1	5	3	
Quail	4	4	2	4	4	5	2	1	4	3	
Woodcock			1	3	3	4	4	2	3		
Small game:											
Cottontail	3	4	3	5	5	5	3	1	2	3	
Raccoon	3	4		1	1	2	4		1	5	4
Squirrels, fox and gray	3	4		1	1	2	5	1			
Large game:											
Deer	3	4	3	3	4	4	4	4	3	3	2
Furbearers:											
Beaver						4	5		4	4	5
Fox, red [1]	2	3	2	3	3	3	2	1	3	3	1
Mink [1]						2	1	1	3	5	5
Muskrat	1	1				1			4	5	5

[1] Carnivorous species not strictly dependent on elements listed.

of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 9 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crops.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH value. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink swell potential is the relative change in volume to be expected in soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 9, pertains to potential soil induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to such soil properties as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity of concrete is influenced mainly by the content of sodium or magnesium sulfate, but it is also influenced by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. In most such construction projects as backfilling a trench, driving a piling, or covering a conduit, the steel will come in contact with the soil material of more than one horizon. Thus, the potential for corrosion of uncoated steel is increased. A corrosivity rating of *low* means that there is a low probability of soil induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations of the soils for town and country planning

The estimated interpretations in table 10 are based on the engineering properties of soils shown in table 9, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Eau Claire County. In table 10 ratings are used to summarize limitations or suitability of the soils for all listed purposes.

Soil limitations are indicated by the ratings *slight,*

TABLE 8.—*Degree and kind of*

Recreation groups and map symbols	Camp areas [1]	Picnic areas
Group 1: Deep to moderately deep, well drained to somewhat excessively drained loams, silt loams, and very fine sandy loams: DaA, FpB, FpC, GaB, GaC2, GaD2, GaE, HeC2, HnB, HnC2, HnD2, MeA, MeB, MeC2, MmA, MrB, MrC2, Ms, NrC2, NrD2, NrE2, OsB, OsC2, PcB, SeB, SeC2, SeD2, SeE2, SfB, SmA, SmB, TeA, TeB, UnD2, UnE, Wh.	Moderate if slopes are 0 to 12 percent; severe if slopes are more than 12 percent; erodible where soil slopes; compacts easily; wet and soft after rain.	Slight if slopes are 0 to 6 percent; moderate if slopes are 6 to 12 percent; severe if slopes are more than 12 percent; erodible on slopes; compacts easily when wet.
Group 2: Moderately deep, moderately well drained to somewhat excessively drained sandy loams and loamy sands: AtB, AtC2, AtD2, BlB, BlC2, BlD2, BmA, DuA, ElB, ElC2, ElD2, LuB, LuC.	Slight if slopes are 0 to 6 percent; moderate if slopes are 6 to 12 percent; severe if slopes are more than 12 percent; erodible where soil slopes.	Slight if slopes are 0 to 6 percent; moderate if slopes are 6 to 12 percent; severe if slopes are more than 12 percent; erodible on slopes.
Group 3: Shallow, well drained and somewhat excessively drained soils: BuA, CeA, CkB, CkC2, CkD2, EmB, EmC2, EmD2, EmE, NtB, NtC2, NtD2, NtE2, NtF.	Slight if slopes are 0 to 6 percent; moderate if slopes are 6 to 12 percent; severe if slopes are more than 12 percent; erodible on slopes.	Slight if slopes are 0 to 6 percent; moderate if slopes are 6 to 12 percent; severe if slopes are more than 12 percent; erodible on slopes.
Group 4: Moderately well drained to excessively drained sands and loamy sands: BoB, BoC, BoE, FrA, GoB, GoC2, GsB, GsC2, MdB, MdC, PdB, PdC2, PfB, PfC2, PlB, PlC2, SpB, Tn, TrB, VlB.	Moderate if slopes are 0 to 6 percent; severe if slopes are more than 6 percent; droughty; vegetation difficult to maintain; erodible.	Moderate if slopes are 0 to 6 percent; severe if slopes are more than 6 percent; droughty; difficult to maintain a good sod; erodible.
Group 5: Dominantly somewhat poorly drained soils: Au, Cu, De, FmA, FmB, FoA, FoB, HkB, KeA, Mo, So.	Moderate: wet and soft for moderate periods; water ponds for short periods in places.	Moderate: wet for moderate periods; sod easily damaged when wet; water ponds for short periods in places.
Group 6: Poorly drained and very poorly drained loamy and sandy soils: Cb, Eo, Er, La, Mc, Na, Vd, Ve.	Severe: wet and soft for long periods; poor trafficability; water ponds for long periods.	Severe: wet for long periods; sod easily damaged; water ponds for long periods; poor trafficability.
Group 7: Soils and land types that are subject to frequent flooding: Ae, Af, ArA, On, Or, Re.	Severe: occasional or frequent flooding; wet for long or short periods; sod easily damaged when wet.	Severe: occasional or frequent flooding; wet for long or short periods; sod easily damaged when wet.
Group 8: Organic soils: Ad, Ho, Ma.	Severe: wet and soft for long periods; poor trafficability; water ponds for short periods in places.	Severe: wet for long periods; sod easily damaged; poor trafficability; water ponds for short periods in places.

[1] Extensive leveling exposes sand and gravel in places, especially in shallow soils.

moderate, and *severe. Slight* means that soil properties are generally favorable for the rated use, or, in other words, limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome that they require major soil reclamation, special designs, or intensive maintenance.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms *slight, moderate,* and *severe.*

The following are explanations of some of the columns in table 10:

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 5 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs (*5*).

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and has sides, or embankments, of

limitations for recreational uses

Playgrounds [1]	Paths and trails	Golf course fairways
Moderate if slopes are 0 to 6 percent; severe if slopes are more than 6 percent; erodible on slopes; compacts easily when wet.	Moderate if slopes are 0 to 12 percent; severe if slopes are more than 12 percent; erodible on slopes; muddy and slippery when wet.	Slight if slopes are 0 to 6 percent; moderate if slopes are 6 to 12 percent; severe if slopes are more than 12 percent; erodible on slopes.
Slight if slopes are 0 to 2 percent; moderate if slopes are 2 to 6 percent; severe if slopes are more than 6 percent; erodible on slopes.	Slight if slopes are 0 to 12 percent; moderate if slopes are 12 to 20 percent; severe if slopes are more than 20 percent; erodible on slopes.	Slight if slopes are 0 to 6 percent; moderate if slopes are 6 to 12 percent; severe if slopes are more than 12 percent; erodible on slopes.
Slight if slopes are 0 to 2 percent; moderate if slopes are 2 to 6 percent; severe if slopes are more than 6 percent; erodible on slopes; extensive leveling can expose sand and gravel or bedrock.	Slight if slopes are 0 to 12 percent; moderate if slopes are 12 to 20 percent; severe if slopes are more than 20 percent; erodible on slopes.	Slight if slopes are 0 to 6 percent; moderate if slopes are 6 to 12 percent; severe if slopes are more than 12 percent; erodible on slopes.
Moderate if slopes are 0 to 2 percent; severe if slopes are more than 2 percent; droughty; difficult to maintain a good sod; erodible; leveling exposes loose sand.	Moderate if slopes are 0 to 12 percent; severe if slopes are more than 12 percent; droughty; poor stability on slopes; erodible; difficult to maintain.	Moderate if slopes are 0 to 6 percent; severe if slopes are more than 6 percent; erodible; droughty; difficult to maintain a good turf.
Moderate: wet for moderate periods; sod easily damaged when wet; water ponds for short periods in places.	Moderate: wet for moderate periods; muddy and slippery when wet.	Moderate: seasonal high water table; water management needed; turf easily damaged when wet.
Severe: wet for long periods; sod easily damaged; water ponds for long periods; poor trafficability.	Severe: wet for long periods; muddy and slippery when wet; poor trafficability.	Severe: high water table; low trafficability when wet; turf easily damaged when wet.
Severe: occasional or frequent flooding; wet for long or short periods; sod easily damaged when wet.	Severe: occasional or frequent flooding; wet for long or short periods; muddy and slippery when wet.	Very severe: frequent flooding; wet for short or long periods.
Severe: wet for long periods; sod easily damaged; poor trafficability; water ponds for short periods in places.	Severe: wet for long periods; poor trafficability; difficult to maintain.	Severe: high water table; turf easily damaged when wet; low trafficability when wet; remains wet and soft for long periods.

compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter content, and slope. If the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, such as excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 10, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

TABLE 9.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such
Absence of data indicates that the soil is too variable to be rated or that no estimate

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
	Feet	*Feet*	*Inches*				*Percent*
Adrian: Ad	>5	0–1	0–36	Muck	Pt		0
			36–60	Sand	SP or SP–SM	A–3	0
Alluvial land, sandy: Ae Most properties are too variable to be rated.							
Alluvial land, wet: Af Most properties are too variable to be rated.							
Arenzville: ArA	>5	[3] 3–5	0–8	Silt loam	ML	A–4	0
			8–60	Silt loam	ML or CL	A–4 or A–6	0
Arland: AtB, AtC2, AtD2	1½–3½	>5	0–13	Sandy loam	SM	A–2 or A–4	0
			13–34	Sandy loam	SM	A–2 or A–4	0
			34–40	Loamy sand	SM	A–2	0
			40–60	Sandstone.			
Au Gres: Au	>5	1–3	0–60	Sand	SP	A–3	0
Billett: BlB, BlC2, BlD2, BmA [4]	>5	>5	0–8	Sandy loam	SM	A–2 or A–4	0
			8–34	Sandy loam	SM	A–2	0
			34–60	Sand	SP–SM	A–3	0
*Boone: BoB, BoC, BoE For Plainbo parts, see Plainbo series.	1½–3½	>5	0–26	Sand	SP–SM	A–3	0
			26–60	Sandstone.			
Burkhardt: BuA	>5	>5	0–10	Sandy loam	SM	A–2	0
			10–16	Sandy loam	SM	A–2	0
			16–60	Sand and gravel	SP	A–1	0–10
Cable: Cb	>5	0–1	0–8	Loam	ML	A–4	0
			8–15	Sandy loam	SM	A–2	0
			15–36	Loam	ML or CL	A–4	0
			36–60	Sandy loam	SM	A–2 or A–4	0
Caryville: CeA	>5	[3] >5	0–16	Loam	ML	A–4	0
			16–24	Loamy sand	SM	A–2	0
			24–60	Sand	SP–SM or SM	A–3 or A–2	0
Chetek: CkB, CkC2, CkD2	>5	>5	0–10	Sandy loam	SM	A–2	0
			10–16	Sandy loam	SM or ML	A–2 or A–4	0
			16–60	Sand and gravel	SP	A–1 or A–3	0–10
Curran: Cu	>5	1–3	0–17	Silt loam	ML	A–4	0
			17–34	Heavy silt loam	ML or CL	A–4	0
			34–44	Silt loam	ML	A–4	0
			44–60	Medium and fine sand.	SP–SM or SM	A–2 or A–3	0
Dakota: DaA	>5	>5	0–16	Loam	ML	A–4	0
			16–30	Loam	ML or CL	A–4	0
			30–60	Sand	SP	A–3	0
Dells: De	>5	1–3	0–16	Silt loam	ML	A–4	0
			16–31	Silt loam	CL	A–6	0
			31–35	Loam	SC–SM, SM, ML, or CL–ML	A–4	0
			35–60	Sand	SP–SM	A–3 or A–1	0

See footnotes at end of table.

significant to engineering

mapping units may have different properties, and for this reason it is necessary to follow carefully the instructions for referring to another series. was made. The symbol > means greater than; the symbol < means less than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH value*			
						6.0–20.0	0.25–0.35	5.6–7.3		Moderate	Moderate.
100	100	65–80	5–10		[2] NP	6.0–20.0	0.05–0.07	5.6–7.3	Low	Moderate	Moderate.
						6.0–20.0	0.05–0.12				
							0.11–0.24				
100	100	90–100	85–100	25–35	5–6	0.6–2.0	0.22–0.24	5.6–6.0	Low	Moderate	Moderate.
100	100	90–100	85–100	25–45	5–12	0.6–2.0	0.20–0.22	5.6–6.0	Low	Moderate	Moderate.
95–100	80–90	60–70	30–40	10–20	2–4	2.0–6.0	0.16–0.18	5.1–6.5	Low	Moderate	High.
95–100	80–90	60–70	30–40	15–25	1–3	0.6–2.0	0.16–0.18	5.1–6.5	Low	Moderate	High.
95–100	85–95	65–75	15–25		NP	2.0–6.0	0.09–0.11	5.1–6.5	Low	Moderate	High.
100	100	60–80	1–5		NP	6.0–20.0	0.05–0.07	5.1–6.0	Low	Moderate	High.
100	100	75–85	25–40	10–20	1–4	2.0–6.0	0.13–0.15	6.6–7.3	Low	Low	Low.
95–100	95–100	60–70	25–35	10–20	1–4	2.0–6.0	0.12–0.14	5.1–6.5	Low	Low	High.
95–100	90–95	50–70	5–10		NP	6.0–20.0	0.05–0.07	5.1–5.5	Low	Low	High.
100	100	60–80	5–10		NP	>20.0	0.06–0.08	5.1–5.5	Low	Low	High.
95–100	95–100	55–65	25–35	10–20	1–4	2.0–6.0	0.12–0.14	5.1–5.5	Low	Low	High.
95–100	95–100	55–65	25–35	10–20	1–4	2.0–6.0	0.12–0.14	5.6–6.0	Low	Low	Moderate.
70–85	50–75	25–30	1–5		NP	6.0–20.0	0.02–0.04	5.6–6.0	Low	Low	Moderate.
95–100	95–100	85–90	55–65	15–20	2–4	0.6–2.0	0.20–0.22	5.6–6.0	Low	Moderate	Moderate.
95–100	95–100	65–70	25–35	15–20	2–4	0.6–2.0	0.14–0.19	5.6–6.0	Low	Moderate	Moderate.
95–100	95–100	75–85	50–70	20–30	2–8	0.6–2.0	0.16–0.19	5.6–6.0	Low	Moderate	Moderate.
90–95	80–90	55–65	30–45	10–20	2–4	0.6–2.0	0.11–0.13	5.6–6.5	Low	Moderate	Moderate.
100	100	85–90	50–60	20–30	1–4	0.6–2.0	0.20–0.22	6.1–6.5	Low	Low	Moderate.
100	100	50–75	10–20		NP	2.0–6.0	0.09–0.11	5.6–6.0	Low	Low	Moderate.
95–100	95–100	50–70	1–5		NP	6.0–20.0	0.05–0.07	5.6–6.0	Low	Low	Moderate.
95–100	95–100	60–70	30–35	10–20	NP–4	2.0–6.0	0.13–0.15	5.6–6.0	Low	Low	Moderate.
90–100	90–100	60–70	30–55	15–25	1–4	2.0–6.0	0.12–0.14	5.1–5.5	Low	Low	High.
75–85	60–85	20–35	1–5		NP	6.0–20.0	0.05–0.07	5.6–6.0	Low	Low	Moderate.
100	100	95–100	85–95	20–25	2–5	0.6–2.0	0.22–0.24	5.1–6.5	Low	High	Moderate.
100	100	95–100	90–95	25–35	5–12	0.2–0.6	0.20–0.22	4.5–5.5	Low	High	High.
100	100	95–100	90–100	20–30	NP–5	0.6–2.0	0.14–0.22	5.1–5.5	Low	High	Moderate.
100	100	50–75	5–30		NP	0.6–2.0	0.05–0.10	5.1–5.5	Low	Moderate	Moderate.
100	95–100	75–90	50–65	20–30	1–4	2.0–6.0	0.20–0.22	5.6–6.5	Low	Low	Moderate.
95–100	95–100	75–90	50–65	20–30	2–8	2.0–6.0	0.17–0.19	5.1–5.5	Low	Low	Moderate.
95–100	90–95	50–65	1–5		NP	6.0–20.0	0.05–0.07	5.1–5.5	Low	Low	Moderate.
100	100	95–100	90–95	25–35	2–4	0.6–2.0	0.20–0.22	5.6–6.5	Low	Moderate	Moderate.
100	100	90–100	85–95	30–40	15–20	0.6–2.0	0.18–0.20	5.1–5.5	Low	Moderate	Moderate.
100	95–100	60–70	40–55	20–25	2–6	0.6–2.0	0.13–0.18	5.1–5.5	Low	Moderate	Moderate.
95–100	95–100	45–55	5–10		NP	6.0–20.0	0.06–0.08	5.6–6.0	Low	Moderate	Moderate.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
	Feet	*Feet*	*Inches*				*Percent*
Dunnville: DuA	>5	>5	0–12	Sandy loam	SM	A–2	0
			12–25	Sandy loam	SM	A–2 or A–4	0
			25–30	Loamy sand	SM	A–2	0
			30–60	Sand	SP	A–3	0
Eleva: EIB, EIC2, EID2	1½–3½	>5	0–9	Sandy loam	SM	A–2	0
			9–25	Light loam and sandy loam.	SM	A–2	0
			25–28	Sand	SP	A–3	0
			28–60	Sandstone.			
Elkmound: EmB, EmC2, EmD2, EmE	1–2	>5	0–12	Loam	CL–ML or ML	A–4	0
			12–60	Sandstone.			
Elm Lake: Eo	1½–3½	0–1	0–7	Loamy sand	SM or SP–SM	A–2 or A–3	0
			7–27	Sand	SP or SP–SM	A–3	0
			27–36	Loam	CL	A–6	0
			36–60	Sandstone.			
Ettrick: Er	>5	[3] 0–1	0–12	Silt loam	ML or CL–ML	A–4	0
			12–26	Silty clay loam	CL or ML	A–7	0
			26–32	Silt loam	CL or ML	A–4	0
			32–60	Silt and very fine sand.	ML	A–4	0
*Fairchild: FmA, FmB For Merrillan parts, see Merrillan series.	1½–3½	1–3	0–10	Loamy sand	SM	A–2	0
			10–19	Loamy fine sand	SM	A–2	0
			19–33	Sand	SP–SM	A–3	0
			33–40	Loam	ML	A–4	0
			40–60	Sandstone and shale.			
Fallcreek: FoA, FoB	>5	1–3	0–16	Sandy loam	SM	A–4 or A–2	0
			16–42	Loam	CL or SC	A–6	0
			42–60	Loam	CL, CL–ML, SC, or SM–SC	A–4	0–3
Fallcreek variant: FpB, FpC	>5	3–5	0–8	Loam	ML or CL–ML	A–4	0–10
			8–30	Loam	ML or CL	A–4	0
			30–60	Heavy loam	CL	A–6	0
Friendship: FrA	>5	3–5	0–18	Loamy sand	SM	A–1	0
			18–60	Sand	SP–SM	A–1	0
Gale: GaB, GaC2, GaD2, GaE	1½–3½	>5	0–13	Silt loam	ML or CL–ML	A–4	0
			13–26	Heavy silt loam	CL	A–6	0
			26–31	Loam	CL or ML	A–4	0
			31–38	Sand	SP	A–3	0
			38–60	Sandstone.			
Gotham:							
GoB, GoC2	>5	>5	0–8	Loamy sand	SM	A–1	0
			8–28	Loamy fine sand	SM	A–1	0
			28–60	Sand	SM or SP–SM	A–1 or A–2	0
GsB, GsC2	3–5	>5	0–8	Loamy sand	SM	A–1	0
			8–28	Loamy fine sand	SM	A–1	0
			28–40	Sand	SM or SP–SM	A–1 or A–2	0
			40–60	Sandstone.			

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH value*			
100	100	75–85	25–35	>20	NP–5	2.0–6.0	0.13–0.18	5.6–6.0	Low	Low	Moderate.
100	100	65–75	30–40		NP–5	2.0–6.0	0.13–0.14	5.6–6.0	Low	Low	Moderate.
100	100	60–80	15–25		NP	2.0–6.0	0.12–0.19	5.6–6.0	Low	Low	Moderate.
100	100	60–70	1–30		NP	2.0–6.0	0.05–0.07	5.6–6.0	Low	Low	Moderate.
100	100	75–85	25–35	10–20	2–4	0.6–2.0	0.13–0.15	5.6–6.5	Low	Low	Moderate.
100	100	75–85	25–35	10–20	2–4	0.6–2.0	0.13–0.15	4.5–6.0	Low	Low	High.
100	100	60–70	1–5		NP	2.0–6.0	0.06–0.08	5.1–5.5	Low	Low	High.
100	100	70–90	60–70	10–20	2–6	0.6–2.0	0.20–0.22	5.1–6.5	Low	Low	Moderate.
100	100	80–90	5–10		NP	2.0–6.0	0.09–0.11	4.5–5.5	Low	Moderate	High.
100	100	51–60	5–10		NP	2.0–6.0	0.07–0.09	5.6–6.0	Low	Moderate	Moderate.
100	85–95	75–85	70–80	30–40	15–35	0.06–0.2	0.18–0.20	4.5–5.0	Moderate	High	High.
100	100	95–100	80–100	10–25	2–4	0.6–2.0	0.22–0.24	5.6–6.5	Moderate	Moderate	Low.
100	100	95–100	80–100	41–50	15–25	0.2–0.6	0.18–0.20	6.1–6.5	Moderate	Moderate	Low.
100	100	95–100	90–100	20–30	5–10	0.6–2.0	0.20–0.22	6.1–6.5	Low	Moderate	Low.
100	100	85–90	60–70	10–25	1–4	0.6–2.0	0.17–0.19	6.6–7.3	Low	Low	Low.
100	100	50–60	15–20		NP	6.0–20.0	0.10–0.12	4.5–5.0	Low	High	High.
100	100	50–60	15–20		NP	6.0–20.0	0.09–0.11	5.1–5.5	Low	High	High.
100	100	70–80	5–10		NP	6.0–20.0	0.06–0.08	5.6–6.0	Low	Moderate	Moderate.
100	100	85–95	60–70	10–30	2–4	0.2–0.6	0.17–0.19	4.5–5.0	Low	High	High.
95–100	95–100	75–85	30–40	10–20	2–4	2.0–6.0	0.15–0.17	5.1–6.0	Low	Moderate	High.
95–100	90–100	80–90	45–60	25–35	10–20	0.2–0.6	0.17–0.18	4.5–5.5	Low	Moderate	High.
95–100	90–100	65–75	40–55	20–30	5–10	0.2–0.6	0.12–0.16	6.1–6.5	Low	Moderate	Moderate.
85–100	85–100	85–95	60–75	25–35	2–8	0.6–2.0	0.20–0.22	6.1–6.5	Low	Moderate	Low.
80–100	85–100	85–95	60–75	25–35	5–10	0.2–0.6	0.17–0.19	5.1–6.0	Low	Moderate	Moderate.
90–100	85–100	85–95	60–80	25–40	11–15	0.2–0.6	0.17–0.19	5.1–6.0	Moderate	Moderate	Moderate.
100	100	30–40	10–20		NP	6.0–20.0	0.10–0.12	5.6–6.0	Low	Low	Moderate.
100	100	25–35	5–10		NP	6.0–20.0	0.06–0.08	5.1–5.5	Low	Moderate	High.
100	100	90–100	80–95	25–35	2–8	0.6–2.0	0.22–0.24	5.6–6.5	Low	Moderate	Low.
100	100	90–100	85–95	25–35	11–15	0.6–2.0	0.18–0.20	5.1–5.5	Low	Moderate	Moderate.
100	100	90–100	60–75	20–30	5–10	0.6–2.0	0.17–0.19	5.1–5.5	Low	Moderate	Moderate.
100	100	60–70	1–5		NP	6.0–20.0	0.05–0.07	5.6–6.0	Low	Low	Moderate.
100	100	40–50	15–25		NP	6.0–20.0	0.10–0.12	6.1–6.5	Low	Low	Moderate.
100	100	40–50	15–25		NP	6.0–20.0	0.10–0.12	6.1–6.5	Low	Low	Moderate.
100	100	40–60	10–30		NP	6.0–20.0	0.07–0.14	6.1–6.5	Low	Low	Moderate.
100	100	40–50	15–25		NP	6.0–20.0	0.10–0.12	6.1–6.5	Low	Low	Moderate.
100	100	40–50	15–25		NP	6.0–20.0	0.10–0.11	6.1–6.5	Low	Low	Moderate.
100	100	40–60	10–30		NP	6.0–20.0	0.07–0.14	6.1–6.5	Low	Low	Moderate.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
	Feet	*Feet*	*Inches*				*Percent*
*Hiles: HeC2, HkB	1½–3½	3–5	0–8	Silt loam	ML	A–4	0
			8–22	Silt loam	CL or CL–ML	A–4	0
For Kert part of HkB, see Kert series.			22–27	Silty clay loam	CL	A–6	0
			27–60	Sandstone and shale.			
Hixton: HnB, HnC2, HnD2	1½–3½	>5	0–15	Loam	ML or CL–ML	A–4	0
			15–23	Loam	ML or CL–ML	A–4	0
			23–27	Sandy loam	SM	A–2 or A–4	0
			27–36	Sand	SP	A–3	0
			36–60	Sandstone.			
Houghton: Ho	>5	0–1	0–60	Muck	Pt		0
Humbird	1½–3½	3–5	0–31	Sandy loam	SM	A–2 or A–4	0
			31–38	Silty clay	CL	A–7	0
Mapped only with Ludington soils.			38–60	Sandstone and shale.			
Kert: KeA	1½–3½	1–3	0–15	Loam	ML or CL–ML	A–4	0
			15–28	Heavy loam	CL	A–6	0
			28–36	Sandy loam	SM or SC–SM	A–2 or A–4	0
			36–60	Sandstone and shale.			
Lows: La	>5	0–1	0–28	Loam	ML or CL–ML	A–4	0
			28–60	Sand	SP	A–3	0
*Ludington: LuB, LuC	1½–3½	3–5	0–18	Loamy sand	SM	A–2 or A–1	0
			18–26	Sand	SP–SM	A–1	0
For Humbird parts, see Humbird series.			26–35	Loam	ML or CL–ML	A–4	0
			35–60	Sandstone and shale.			
Markey: Ma	>5	0–1	0–30	Muck	Pt		0
			30–60	Sand	SP	A–3	0
Marshan: Mc	>5	0–1	0–16	Loam	ML	A–4	0
			16–26	Loam	ML or CL	A–4 or A–6	0
			26–34	Silt loam	ML or CL	A–4 or A–6	0
			34–38	Sandy loam	SM	A–2 or A–4	0
			38–60	Sand	SP	A–3	0
Menahga: MdB, MdC	>5	>5	0–60	Sand	SP	A–3	0
Meridian: MeA, MeB, MeC2, MmA [4]	>5	>5	0–30	Loam	ML	A–4	0
			30–60	Sand	SP	A–3	0
Merrillan	1½–3½	1–3	0–13	Sandy loam	SM	A–2 or A–4	0
			13–18	Loamy sand	SM	A–2	0
Mapped only with Fairchild soils.			18–23	Heavy loam	CL	A–4 or A–6	0
			23–30	Silty clay loam	CL	A–6 or A–7	0
			30–60	Sandstone and shale.			
Morocco: Mo	>5	1–3	0–16	Loamy sand	SM	A–2	0
			16–60	Sand	SP	A–3	0
Mt. Carroll: MrB, MrC2 [5], Ms [6]	>5	>5	0–9	Silt loam	ML	A–4	0
			9–44	Silt loam	CL	A–6	0
			44–60	Silt loam	ML or CL	A–4 or A–6	0

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH value*			
100	100	80–90	65–75	20–30	2–4	0.6–2.0	0.22–0.24	5.1–5.5	Low	Moderate	Moderate.
100	100	80–90	65–75	20–30	5–10	0.6–2.0	0.20–0.22	4.5–5.0	Low	Moderate	High.
100	90–95	75–85	50–60	25–35	11–15	0.06–0.2	0.18–0.20	4.5–5.0	Moderate	Moderate	High.
100	100	75–90	55–65	15–25	1–5	0.6–2.0	0.20–0.22	6.1–6.5	Low	Low	Low.
100	100	75–90	55–70	20–30	2–8	0.6–2.0	0.18–0.20	5.1–5.5	Low	Low	Moderate.
100	100	60–70	30–40	15–25	1–4	2.0–6.0	0.12–0.14	5.1–5.5	Low	Low	High.
100	100	60–70	1–5		NP	6.0–20.0	0.05–0.07	5.1–5.5	Low	Low	High.
						6.0–20.0	0.35–0.45	5.6–6.5		High	Moderate.
100	100	60–70	30–40	10–20	2–6	0.6–2.0	0.10–0.16	4.5–5.5	Low	Moderate	High.
100	100	90–100	85–95	40–50	20–30	0.2–0.6	0.18–0.20	4.5–5.0	Moderate	High	High.
100	100	85–95	55–65	20–35	2–8	0.6–2.0	0.18–0.22	4.5–6.5	Low	High	High.
100	100	80–90	55–75	25–35	11–15	0.2–0.6	0.17–0.19	4.5–5.0	Low	High	High.
100	100	65–75	30–40	15–25	3–7	0.6–2.0	0.11–0.13	4.5–5.0	Low	High	High.
100	100	70–80	60–70	25–35	2–8	0.6–2.0	0.16–0.20	5.1–5.5	Low	Moderate	Moderate.
100	100	70–80	1–5		NP	6.0–20.0	0.04–0.06	5.1–5.5	Low	Moderate	High.
100	100	40–65	15–25		NP	6.0–20.0	0.10–0.12	<4.5–5.0	Low	Moderate	High.
100	100	40–50	5–10		NP	6.0–20.0	0.06–0.08	<4.5–5.0	Low	Moderate	High.
100	100	85–95	60–70	10–20	2–6	0.2–0.6	0.17–0.19	<4.5–5.0	Low	Moderate	High.
						6.0–20.0	0.35–0.45	5.6–6.0		Moderate	Moderate.
100	100	60–75	1–5		NP	6.0–20.0	0.03–0.06	5.6–6.0	Low	Moderate	Moderate.
100	100	85–95	60–75	20–30	1–4	0.6–2.0	0.18–0.22	5.6–6.0	Low	Moderate	Moderate.
100	100	85–95	60–75	20–30	5–12	0.6–2.0	0.17–0.18	5.6–6.0	Low	Moderate	Moderate.
100	100	80–90	70–90	20–30	5–12	0.6–2.0	0.20–0.22	5.6–6.0	Low	Moderate	Moderate.
100	100	60–70	30–40	10–30	2–4	2.0–6.0	0.11–0.14	5.6–6.0	Low	Moderate	Moderate.
100	100	60–70	1–5		NP	6.0–20.0	0.05–0.07	5.6–6.0	Low	Moderate	Moderate.
100	100	55–75	1–4		NP	6.0–20.0	0.05–0.07	4.5–6.5	Low	Moderate	High.
100	100	85–95	55–65	25–35	2–6	0.6–2.0	0.20–0.22	5.1–6.5	Low	Low	Moderate.
100	100	60–70	1–5		NP	6.0–20.0	0.05–0.07	5.1–5.5	Low	Low	High.
100	100	60–70	25–40	20–30	1–4	2.0–6.0	0.13–0.15	4.5–5.5	Low	High	High.
100	100	50–75	15–25		NP	2.0–6.0	0.08–0.10	5.1–5.5	Low	High	High.
100	100	85–95	60–80	25–35	7–15	0.6–2.0	0.17–0.19	4.5–5.0	Moderate	High	High.
100	100	95–100	70–90	35–50	15–30	0.06–0.2	0.18–0.20	4.5–5.0	Moderate	High	High.
100	100	60–80	15–25		NP	6.0–20.0	0.10–0.12	5.1–6.5	Low	Moderate	High.
100	100	51–70	1–5		NP	6.0–20.0	0.05–0.07	5.1–5.5	Low	Moderate	High.
100	100	90–100	80–95	25–35	2–6	0.6–2.0	0.22–0.24	6.6–7.3	Low	Low	Low.
100	100	90–100	80–95	25–35	10–20	0.6–2.0	0.18–0.22	4.5–6.0	Moderate	Low	High.
100	100	90–100	70–90	25–35	5–12	0.6–2.0	0.20–0.22	5.6–6.0	Low	Low	High.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
	Feet	*Feet*	*Inches*				*Percent*
Newson: Na	>5	0–1	0–9	Loamy sand	SM or SP–SM	A–2	0
			9–60	Sand	SP–SM or SM	A–3	0
Norden: NrC2, NrD2, NrE2	1½–3½	>5	0–14	Silt loam	ML or CL	A–4 or A–6	0
			14–24	Loam	CL	A–4 or A–6	0
			24–30	Very fine sandy loam.	ML, CL–ML, SM, or SC–SM	A–4 or A–2	0
			30–60	Sandstone.			
Northfield: NtB, NtC2, NtD2, NtE2, NtF	1–2	>5	0–7	Silt loam	ML	A–4	0
			7–16	Heavy silt loam	ML or CL	A–4 or A–6	0
			16	Sandstone.			
Orion: On	>5	[3] 1–3	0–60	Silt loam	ML or CL	A–4 or A–6	0
Otter: Or	>5	[3] 0–1	0–60	Silt loam	ML or CL	A–4 or A–6	0
Otterholt: OsB, OsC2	>5	>5	0–56	Silt loam	ML or CL	A–4 or A–6	0
			56–60	Fine sandy loam	SM or SC–SM	A–4	0
Pillot: PcB	>5	>5	0–16	Silt loam	ML	A–4	0
			16–34	Heavy silt loam	ML or CL	A–4 or A–6	0
			34–38	Sandy loam	SM	A–2 or A–4	0
			38–60	Sand	SP	A–3	0
Plainbo: PdB, PdC2	1–5	>5	0–13	Loamy sand	SM	A–2	0
			13–29	Sand	SP or SP–SM	A–3	0
			29–60	Sandstone.			
Plainfield:							
PfB, PfC2	>5	>5	0–15	Loamy sand	SM	A–2	0
			15–60	Sand	SP	A–3	0
PlB, PlC2	>5	>5	0–15	Loamy sand	SM	A–2	0
			15–40	Sand	SP	A–3	0
			40–55	Sandy loam	SM	A–2	0
			55–60	Sand	SP	A–3	0
Riverwash: Re							
Most properties are too variable to be rated.							
Seaton: SeB, SeC2, SeD2, SeE2,[5] SfB,[6] SmA,[6] SmB.[6]	>5	>5	0–12	Silt loam	ML	A–4	0
			12–34	Heavy silt loam	CL	A–4 or A–6	0
			34–60	Silt loam	ML or CL	A–4	0
Shiffer: So	>5	1–3	0–8	Loam	ML	A–4	0
			8–30	Loam	CL	A–4 or A–6	0
			30–60	Sand	SP–SM or SM	A–2 or A–3	0
Sparta: SpB	>5	>5	0–24	Loamy sand	SM or SP–SM	A–2	0
			24–60	Sand	SP	A–3	0
Tell: TeA, TeB	>5	>5	0–10	Silt loam	ML or CL–ML	A–4	0
			10–30	Heavy silt loam	ML or CL	A–4 or A–6	0
			30–34	Loam	ML or CL	A–4	0
			34–60	Sand	SP	A–3	0
Terrace escarpments, sandy: Tn							
Most properties are too variable to be rated.							

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH value*			
100	90–100	51–60	10–20	-------	NP	6.0–20.0	0.10–0.12	5.1–5.5	Low------	Moderate--	High.
100	90–100	51–60	5–15	-------	NP	6.0–20.0	0.05–0.08	5.1–5.5	Low------	Moderate--	High.
100	95–100	75–85	55–85	20–30	3–12	0.6–2.0	0.22–0.24	5.1–6.5	Low------	Low------	Low.
100	95–100	90–100	55–80	25–35	10–25	0.6–2.0	0.16–0.20	5.1–5.5	Low------	Low------	Moderate.
100	95–100	85–95	20–55	10–20	1–7	0.6–2.0	0.16–0.19	5.6–6.0	Low------	Low------	Moderate.
100	95–100	80–95	75–90	15–25	1–4	0.6–2.0	0.22–0.24	6.1–6.5	Low------	Low------	Low.
100	90–100	75–90	70–90	25–35	5–12	0.6–2.0	0.20–0.22	6.1–6.5	Low------	Low------	Low.
100	100	80–90	80–90	25–35	2–12	0.6–2.0	0.20–0.22	5.6–6.5	Low------	High------	Low.
100	95–100	90–100	90–100	25–35	2–12	0.6–2.0	0.20–0.22	5.6–6.5	Low------	High------	Low.
100	100	90–100	70–95	30–40	3–12	0.6–2.0	0.20–0.22	4.5–7.3	Low------	Low------	High.
100	100	80–90	36–45	15–25	2–8	0.6–2.0	0.14–0.16	5.6–6.0	Low------	Low------	Moderate.
100	100	90–100	85–95	20–30	2–4	0.6–2.0	0.20–0.24	5.1–7.3	Low------	Low------	Moderate.
100	100	90–100	85–95	25–35	5–12	0.6–2.0	0.18–0.20	5.1–5.5	Low------	Low------	Moderate.
100	100	60–70	30–40	10–20	1–4	2.0–6.0	0.12–0.14	5.1–5.5	Low------	Low------	High.
100	100	51–70	2–5	-------	NP	6.0–20.0	0.05–0.07	5.6–6.0	Low------	Low------	Moderate.
100	100	50–85	20–25	-------	NP	6.0–20.0	0.10–0.12	5.1–6.0	Low------	Low------	Moderate.
100	100	60–70	2–10	-------	NP	6.0–20.0	0.06–0.08	5.1–6.0	Low------	Low------	Moderate.
100	100	50–70	20–25	-------	NP	6.0–20.0	0.10–0.12	5.1–5.5	Low------	Low------	High.
100	100	55–60	1–4	-------	NP	6.0–20.0	0.06–0.08	5.6–6.0	Low------	Low------	Moderate.
100	100	50–70	20–25	-------	NP	6.0–20.0	0.10–0.12	5.1–5.5	Low------	Low------	High.
100	100	55–60	1–4	-------	NP	6.0–20.0	0.05–0.07	5.6–6.0	Low------	Low------	Moderate.
100	100	60–70	20–30	10–20	1–4	2.0–6.0	0.10–0.12	5.6–6.0	Low------	Low------	Moderate.
100	100	55–60	1–4	-------	NP	6.0–20.0	0.05–0.07	5.6–6.0	Low------	Low------	Moderate.
-------	-------	-------	-------	-------	-------	6.0–20.0	0.02–0.09	-------	-------	-------	-------
100	100	95–100	90–100	25–35	2–8	0.6–2.0	0.20–0.24	6.1–6.5	Low------	Low------	Low.
100	100	95–100	90–100	25–35	5–12	0.6–2.0	0.20–0.22	5.1–5.5	Low------	Low------	Moderate.
100	100	95–100	90–100	25–35	2–10	0.6–2.0	0.20–0.22	5.1–5.5	Low------	Low------	Moderate.
100	100	85–95	60–70	30–40	2–8	0.6–2.0	0.20–0.22	6.6–7.3	Low------	Low------	Low.
100	100	85–95	55–70	25–35	8–15	0.6–2.0	0.18–0.20	5.1–7.3	Moderate--	Moderate--	Moderate.
100	100	80–95	5–20	-------	NP	6.0–20.0	0.05–0.07	5.1–5.5	Low------	Moderate--	High.
100	100	60–70	10–20	-------	NP	6.0–20.0	0.12–0.14	5.6–6.0	Low------	Low------	Moderate.
100	100	65–75	1–4	-------	NP	>20.0	0.06–0.08	5.6–6.0	Low------	Low------	Moderate.
100	95–100	90–100	90–100	25–35	2–8	0.6–2.0	0.22–0.24	6.6–7.3	Low------	Moderate--	Low.
100	95–100	90–100	90–100	25–35	6–15	0.6–2.0	0.16–0.20	5.0–7.3	Moderate--	Moderate--	Moderate.
100	95–100	90–100	80–100	25–35	5–10	0.6–2.0	0.16–0.20	5.1–5.5	Low------	Moderate--	Moderate.
100	95–100	60–80	1–5	NP	NP	6.0–20.0	0.05–0.07	5.6–6.0	Low------	Low------	Moderate.
-------	-------	-------	-------	-------	-------	6.0–20.0	0.05–0.09	-------	-------	-------	-------

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
	Feet	*Feet*	*Inches*				*Percent*
Trempe: TrB	>5	>5	0–16	Loamy sand	SM	A–2	0
			16–60	Sand	SP–SM	A–3	0
Urne: UnD2, UnE	1½–3½	>5	0–24	Very fine sandy loam.	ML or CL	A–4	0
			24–60	Sandstone.			
Veedum: Vd	1½–3½	0–1	0–12	Silt loam	ML or CL–ML	A–4	0
			12–17	Sandy loam	SM or SM–SC	A–2 or A–4	0
			17–28	Loam	ML or CL	A–4	0
			28–32	Silt loam	ML or CL	A–4	0
			32–38	Sandy loam or sand.	SM	A–2 or A–4	0
			38–60	Sandstone and shale.			
Vesper: Ve	1½–3½	0–1	0–17	Loam	ML or CL–ML	A–4	0
			17–26	Loam	ML or SC–SM	A–4	0
			26–33	Heavy loam	CL	A–6	0
			33–60	Sandstone and shale.			
Vilas: VlB	>5	>5	0–60	Sand	SP	A–3	0
Whitehall: Wh	>5	>5	0–20	Silt loam	ML or CL–ML	A–4	0
			20–46	Heavy silt loam	ML or CL	A–4 or A–6	0
			46–56	Sandy loam	SM	A–2	0
			56–60	Sand	SP	A–3	0

[1] The reaction (pH) of the surface layer of the soils is often higher than the values given because of liming practices.
[2] NP means nonplastic.
[3] Subject to flooding.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil material throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The desirable soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 10 apply only to a depth of about 5 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. Reliable predictions can be made to a depth of 10 or 15 feet for some soils, but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 10, have an all weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load supporting capacity and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink swell potential indicate traffic supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and they reflect the relative ease of excavating the material at borrow areas.

Sand is used in great quantities in many kinds of construction. The ratings in table 10 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand generally has a layer

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction [1]	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH value*			
100	95–100	50–75	15–25	-------	NP	6.0–20.0	0.10–0.12	5.1–6.0	Low------	Low------	High.
100	95–100	65–75	5–10	-------	NP	6.0–20.0	0.05–0.07	6.1–6.5	Low------	Low------	Moderate.
100	95–100	85–95	50–65	10–20	2–10	0.6–2.0	0.18–0.22	5.6–6.5	Low------	Low------	Moderate.
100	100	90–100	85–100	25–35	2–8	0.6–2.0	0.22–0.24	5.1–5.5	Low------	High------	Moderate.
100	100	60–70	30–40	15–25	2–6	2.0–6.0	0.12–0.14	4.5–5.0	Low------	High------	High.
100	100	85–95	60–75	25–35	4–10	0.2–0.6	0.17–0.19	4.5–5.0	Low------	High------	High.
100	100	90–100	85–100	25–35	4–10	0.2–0.6	0.20–0.22	5.1–5.5	Low------	High------	Moderate.
100	100	60–70	30–40	15–25	2–4	2.0–6.0	0.12–0.14	4.5–5.0	Low------	High------	High.
100	100	85–95	60–75	25–35	2–8	0.6–2.0	0.20–0.22	5.1–6.0	Low------	Moderate--	Moderate.
100	100	85–95	35–55	15–25	4–8	0.6–2.0	0.17–0.19	5.1–5.5	Low------	Moderate--	Moderate.
100	100	85–95	55–65	25–35	11–15	0.2–0.6	0.17–0.19	5.1–5.5	Low------	Moderate--	Moderate.
100	100	60–80	1–5	NP	NP	>20.0	0.06–0.08	4.5–6.0	Low------	Low------	High.
100	100	90–100	85–100	25–35	2–8	0.6–2.0	0.22–0.24	5.6–6.5	Low------	Low------	Moderate.
100	100	90–100	85–100	25–35	5–14	0.6–2.0	0.18–0.20	5.6–6.5	Low------	Moderate--	Moderate.
100	100	70–85	25–35	25–35	2–6	2.0–6.0	0.12–0.14	5.6–6.0	Low------	Low------	Moderate.
100	100	51–80	1–5	-------	NP	6.0–20.0	0.05–0.07	6.1–6.5	Low------	Low------	Moderate.

[4] Seasonal water table at a depth of 3 to 5 feet for BmA and MmA soils.
[5] Sandstone occurs at a depth below 40 inches in places.
[6] Sand occurs at a depth below 40 inches in places.

at least 3 feet thick, the top of which is within a depth of 5 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and they do not indicate quality of the deposit. Gravel deposits are indicated by a footnote in this column.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material when, for example, preparing a seedbed; natural fertility of the material or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result to the soils in the area where the topsoil is taken.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage and piping and is of favorable stability, shrink swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage of crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer that restricts movement of water; amount of water held available to plants; and need for drainage or depth to water table or bedrock.

Terraces and diversions are embankments or ridges constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to

TABLE 10.—*Engineering interpretations*

[An asterisk in the first column indicates that at least one mapping unit in that series is made up of two or more kinds of soil. The referring to

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Adrian: Ad	Severe: high water table.	Severe: high water table; rapid permeability.	Severe: high water table; organic material and underlying sand unstable.	Severe: high water table; organic material unstable.	Severe: organic material; high water table.	Severe: high water table; organic material.
Alluvial land, sandy: Ae	Severe: subject to flooding.	Severe: subject to flooding; rapid permeability; seasonal high water table in places.	Severe: sidewall instability; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Alluvial land, wet: Af	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: subject to flooding.
Arenzville: ArA	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding.
Arland: AtB, AtC2	Moderate: [1] moderately deep to sandstone bedrock; slope.[2]	Severe: moderately rapid permeability in substratum; moderately deep to sandstone bedrock.	Moderate: [3] moderately deep to sandstone bedrock.	Moderate: rippable sandstone bedrock in most places.	Severe: moderately deep to sandstone bedrock; rapid permeability in substratum.	Moderate: sandstone bedrock.

See footnotes at end of table.

for town and country planning

soils in such mapping units may have different properties, and for this reason it is necessary to follow carefully the instructions for another series]

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Poor: organic material; high water table.	Poor: variable underlying sand; high water table and organic material hinder excavation.	Surface layer and subsoil poor; organic material; high water table.	Rapid permeability in organic material; rapid permeability in underlying sand; high water table.	Unsuitable organic material; medium shear strength in sand substratum; good compaction characteristics; piping hazard.	High water table; rapid permeability in organic material; rapid permeability in underlying sand; unstable when wet.	High available water capacity; moderately thick organic material over sand; rapid intake rate; very poorly drained; hazard of soil blowing.	Generally not applicable: slopes are 0 to 2 percent; very poorly drained; organic material.
Fair: subject to flooding; seasonal high water table hinders excavation in places.	Fair to poor: variable sand; subject to flooding; high water table hinders excavation in places.	Poor: sandy; subject to flooding.	Rapid permeability; seasonal high water table in places; subject to flooding.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive; subject to flooding.	Very low available water capacity; rapid intake rate; excessively drained; subject to flooding.	Generally not applicable: slopes are 0 to 2 percent; subject to flooding; sandy; difficult to vegetate.
Poor: subject to flooding; variable soil material.	Unsuited: variable soil material.	Fair to poor: variable soil material.	Variable soil material and permeability; high water table.	Variable soil material; medium shear strength in most places; fair to good compaction characteristics; piping hazard.	High water table; subject to flooding.	Moderate to high available water capacity; moderate intake rate; poorly drained; deep soil; subject to flooding.	Generally not applicable: slopes are 0 to 2 percent; poorly drained; subject to flooding.
Poor: subject to flooding; susceptible to frost action.	Unsuited------	Fair to good: subject to flooding; some variability in soil material.	Moderate permeability; subject to flooding.	Medium shear strength; fair to poor compaction characteristics; piping hazard.	Moderate permeability; subject to flooding; seasonal high water table at a depth of 3 to 5 feet.	Very high available water capacity; moderate intake rate; well drained to moderately well drained; deep soil; subject to flooding.	Slopes of 0 to 3 percent; well drained to moderately well drained; subject to flooding.
Fair: moderately deep to weakly cemented sandstone bedrock.	Poor: some fines; weakly cemented sandstone; poorly graded.	Fair in surface layer. Fair to poor in subsoil: few pebbles and stones.	Moderate permeability; weakly cemented sandstone at a depth of 20 to 40 inches.	Medium shear strength; fair to good compaction characteristics; sandstone bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained; moderately deep soil.	Slopes of 2 to 12 percent; sandstone bedrock at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Arland—Continued AtD2	Severe: slope; moderately deep to sandstone bedrock.[2]	Severe: slope.	Severe: slope; moderately deep to sandstone bedrock.	Severe: rippable sandstone bedrock in most places.	Severe: moderately deep to sandstone bedrock; rapid permeability in substratum.	Severe: slope.
Au Gres: Au	Severe: seasonal high water table.	Severe: seasonal high water table; rapid permeability.	Severe: seasonal high water table; sidewall instability.	Severe: seasonal high water table.	Severe: seasonal high water table; rapid permeability.	Moderate: seasonal high water table.
Billett: BlB, BlC2	Slight [2]	Severe: rapid permeability in substratum.	Severe: low sidewall stability.	Slight if slopes are 2 to 6 percent; moderate if slopes are 6 to 12 percent.	Severe: rapid permeability in substratum.	Moderate in subsoil; slight in substratum.
BlD2	Severe: slope.	Severe: slope.	Severe: slope; low sidewall stability.	Severe: slope.	Severe: rapid permeability in substratum.	Severe: slope.
BmA	Severe: seasonal high water table.	Severe: rapid permeability in substratum.	Severe: low sidewall stability; seasonal high water table at depth of 3 to 5 feet.	Moderate: in places seasonal high water table; danger of basement seepage.	Severe: seasonal high water table; rapid permeability in substratum.	Moderate: in places seasonal high water table is a concern in lower part of subsoil and in substratum.
*Boone: BoB, BoC For Plainbo parts, see Plainbo series.	Moderate: [1] moderately deep to sandstone bedrock; soft sandstone; slope.[2]	Severe: very rapid permeability; moderately deep to sandstone rock; slope.	Moderate: [3] moderately deep to sandstone bedrock; soft sandstone.	Moderate if slopes are 2 to 12 percent; rippable sandstone bedrock in most places.	Severe: moderately deep to sandstone bedrock; rapid permeability in substratum.	Slight if slopes are 2 to 6 percent; moderate if slopes are 6 to 12 percent.

See footnotes at end of table.

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Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair: moderately deep to weakly cemented sandstone bedrock.	Poor: some fines; weakly cemented sandstone; poorly graded.	Poor: slope...	Moderate permeability; weakly cemented sandstone at a depth of 20 to 40 inches; slope.	Medium shear strength; fair to good compaction characteristics; sandstone bedrock at a depth of 2 to 40 inches.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained; moderately deep soil; slope.	Slopes of 12 to 20 percent; sandstone bedrock at a depth of 20 to 40 inches.
Fair: seasonal high water table.	Fair: seasonal high water table.	Poor: sandy; seasonal high water table.	Rapid permeability; seasonal high water table.	Medium shear strength; good compaction characteristics; piping hazard.	Seasonal high water table; rapid permeability; unstable substratum.	Very low available water capacity; rapid intake rate; somewhat poorly drained.	Slopes of 0 to 2 percent; somewhat poorly drained; sandy; difficult to vegetate.
Fair in subsoil; good in substratum.	Good: some fines in upper part.	Fair in surface layer and subsoil.	Moderately rapid permeability in subsoil; rapid permeability in substratum.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained; moderately deep soil.	Slopes of 1 to 12 percent; sand at a depth of 20 to 40 inches.
Fair in subsoil; good in substratum.	Good: some fines in upper part.	Poor: slope...	Moderately rapid permeability in subsoil; rapid permeability in substratum; slope.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained; moderately deep soil; slope.	Slopes of 12 to 20 percent; sand at a depth of 20 to 40 inches.
Fair in subsoil; good in substratum.	Good: some fines in upper part.	Fair in surface layer and subsoil.	Moderately rapid permeability in subsoil; rapid permeability in substratum; seasonal high water table at a depth of 3 to 5 feet.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate; seasonal high water table is at a depth of 3 to 5 feet for short periods.	Low available water capacity; moderate intake rate; moderately well drained; moderately deep soil.	Slopes of 0 to 3 percent; moderately well drained; sand at a depth of 20 to 40 inches.
Good: weakly cemented sandstone bedrock.	Good: weakly cemented sandstone bedrock.	Poor: sandy..	Vary rapid permeability; weakly cemented sandstone at a depth of 20 to 40 inches.	Medium shear strength; fair to good compaction characteristics; piping hazard; sandstone bedrock at a depth of 20 to 40 inches.	Natural drainage is excessive.	Very low available water capacity; rapid intake rate; excessively drained; moderately deep soil; hazard of soil blowing.	Slopes of 2 to 12 percent; sandstone bedrock at a depth of 20 to 40 inches; difficult to vegetate.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Boone—Continued BoE For Plainbo part, see Plainbo series.	Severe: slope.	Severe: slope.	Severe: slope; moderately deep to sandstone bedrock.	Severe: slope.	Severe: slope; sandstone bedrock; rapid permeability in substratum.	Severe: slope; depth to sandstone bedrock.
Burkhardt: BuA	Slight [2]	Severe: rapid permeability in substratum.	Severe: moderate sidewall stability.	Slight	Severe: sand and gravel substratum; rapid permeability.	Slight
Cable: Cb	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table; in places surface water is a concern for short periods.	Severe: high water table.	Severe: high water table.
Caryville: CeA	Severe: subject to flooding.	Severe: rapid permeability in substratum.	Severe: low sidewall stability.	Severe: subject to flooding.	Severe: subject to flooding; sand substratum.	Severe: subject to flooding.
Chetek: CkB, CkC2	Slight [1]	Severe: rapid permeability in substratum; slope.	Severe: moderate sidewall stability.	Slight if slopes are 2 to 6 percent; moderate if slopes are 6 to 12 percent.	Severe: sand and gravel substratum; rapid permeability in substratum.	Slight if slopes are 2 to 6 percent; moderate if slopes are 6 to 12 percent.
CkD2	Severe: slope.	Severe: slope; rapid permeability in substratum.	Severe: slope; moderate sidewall stability.	Severe: slope.	Severe: sand and gravel substratum; rapid permeability in substratum.	Severe: slope.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair to poor: slope hinders excavation; weakly cemented sandstone bedrock.	Good: weakly cemented sandstone bedrock.	Poor: slope; sandy.	Very rapid permeability; weakly cemented sandstone at a depth of 20 to 40 inches; steep.	Medium shear strength; fair to good compaction characteristics; piping hazard; sandstone bedrock at a depth of 20 to 40 inches.	Natural drainage is excessive.	Very low available water capacity; rapid intake rate; excessively drained; moderately deep soil; steep.	Slopes of 12 to 45 percent; sandstone bedrock at a depth of 20 to 40 inches; rock outcrops in places; sandy; difficult to vegetate.
Good	Good: poorly graded sand and gravel.[4]	Fair in surface layer. Poor in subsoil: sandy and gravelly.	Moderately rapid permeability in subsoil; rapid permeability in substratum.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is somewhat excessive.	Low available water capacity; moderately rapid intake rate; somewhat excessively drained; thin soil.	Slopes of 0 to 3 percent; sand and gravel at a depth of 10 to 20 inches.
Poor: high water table.	Poor: high water table.	Poor: high water table.	Moderate permeability; high water table; stones in places.	Medium shear strength; fair to good compaction characteristics; piping hazard.	High water table; moderate permeability; temporary ponding in places; unstable when wet.	Moderate available water capacity; moderate intake rate; poorly drained; deep soil; temporary ponding in places.	Slopes of 0 to 2 percent; poorly drained.
Fair: flooding hinders excavation; pockets of gravel in sand substratum.	Fair: some fines in substratum; pockets of poorly graded gravel in places.	Fair in surface layer: thin. Poor in subsoil: sandy.	Moderate permeability to a depth of about 20 inches; rapid permeability in substratum; subject to flooding.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Well drained; subject to flooding.	Low available water capacity; moderately rapid intake rate; well drained; thin soil; subject to flooding.	Slopes of 0 to 3 percent; sand at a depth of 10 to 20 inches; subject to flooding; difficult to vegetate.
Good	Good: poorly graded sand and gravel.[4]	Fair in surface layer: thin. Poor in subsoil: sandy and gravelly.	Moderately rapid permeability in subsoil; rapid permeability in substratum.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is somewhat excessive.	Low available water capacity; moderately rapid intake rate; somewhat excessively drained; thin soil.	Slopes of 1 to 12 percent; sand and gravel at a depth of 10 to 20 inches.
Fair: slope	Good: poorly graded sand and gravel.[5]	Poor: slope	Moderately rapid permeability in subsoil; rapid permeability in substratum; slope.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is somewhat excessive.	Low available water capacity; moderately rapid intake rate; somewhat excessively drained; thin soil; slope.	Slopes of 12 to 20 percent; sand and gravel at a depth of 10 to 20 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Curran: Cu	Severe: seasonal high water table; moderately slow permeability.	Severe: moderately slow permeability; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table is a concern at times.	Severe: seasonal high water table; susceptible to frost action.
Dakota: DaA	Slight [2]	Severe: rapid permeability in substratum.	Moderate: moderate sidewall stability.	Slight	Severe: rapid permeability in substratum.	Moderate in subsoil; slight in substratum.
Dells: De	Severe: seasonal high water table.	Severe: seasonal high water table; rapid permeability in substratum.	Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table; rapid permeability in substratum.	Severe: seasonal high water table; susceptible to frost action.
Dunnville: DuA	Slight [2]	Severe: moderately rapid permeability in substratum.	Severe: low sidewall stability.	Slight	Severe: moderately rapid permeability in substratum.	Slight
Eleva:						
ElB, ElC2	Moderate: [1] moderately deep to sandstone bedrock.[2]	Severe: moderately rapid permeability in substratum; moderately deep to sandstone bedrock; slope.	Moderate: [3] moderately deep to sandstone bedrock.	Moderate: rippable sandstone bedrock in most places.	Severe: moderately deep to sandstone bedrock; moderately rapid permeability in substratum.	Moderate: depth to sandstone bedrock.
ElD2	Severe: slope.	Severe: slope.	Severe: slope; moderately deep to sandstone bedrock.	Severe: slope.	Severe: moderately deep to sandstone bedrock; rapid permeability in substratum.	Severe: slope.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Poor: seasonal high water table; susceptible to frost action.	Unsuited	Fair in surface layer: thin. Fair in subsoil: seasonal high water table.	Moderately slow permeability in subsoil; seasonal high water table.	Medium to low shear strength; fair to good compaction characteristics; piping hazard.	Seasonal high water table; moderately slow permeability; unstable when wet.	High available water capacity; slow intake rate; somewhat poorly drained; deep soil.	Slopes of 0 to 2 percent; somewhat poorly drained.
Fair in subsoil; good in substratum.	Good: moderately deep to sand substratum.	Fair in surface layer: thin. Fair in subsoil: thin over sand.	Moderately rapid permeability in subsoil; rapid permeability in substratum.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil.	Slopes of 0 to 3 percent; sand at a depth of 20 to 40 inches.
Fair in subsoil: susceptible to frost action. Good in substratum: seasonal high water table.	Fair: sand in substratum; some fines; seasonal high water table.	Fair in surface layer: thin. Poor in subsoil: seasonal high water table; thin over sand.	Moderate permeability in subsoil; rapid permeability in substratum; seasonal high water table.	Medium shear strength in subsoil and substratum; fair compaction characteristics in subsoil; good compaction characteristics in substratum; piping hazard.	Seasonal high water table; moderate permeability in subsoil; rapid permeability in substratum; unstable when wet.	Moderate available water capacity; moderate intake rate; somewhat poorly drained; moderately deep soil.	Slopes of 0 to 2 percent; somewhat poorly drained; sand at a depth of 20 to 40 inches.
Good: some fines in subsoil.	Fair: moderately deep to substratum.	Good in surface layer. Poor in subsoil: thin over sand.	Moderately rapid permeability in subsoil and substratum.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate.	Low available water capacity; moderately rapid intake rate; well drained; moderately deep soil.	Slopes of 0 to 3 percent; sand at a depth of 20 to 40 inches.
Good: moderately deep to sandstone bedrock.	Poor: some fines; sandstone.	Good	Moderate permeability in subsoil; moderately rapid permeability in substratum; sandstone bedrock at a depth of 20 to 40 inches.	Medium shear strength; fair compaction characteristics; piping hazard; sandstone at a depth of 20 to 40 inches.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained to somewhat excessively drained; moderately deep soil.	Slopes of 2 to 12 percent; sandstone bedrock at a depth of 20 to 40 inches.
Fair: moderately deep to sandstone bedrock; slope.	Fair: some fines; sandstone.	Poor: slope; thin; sandy; depth to sandstone bedrock.	Moderate permeability in subsoil; rapid permeability in substratum; sandstone bedrock at a depth of 20 to 40 inches.	Medium shear strength; fair compaction characteristics; piping hazard; sandstone at a depth of 20 to 40 inches.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained to somewhat excessively drained; moderately deep soil.	Slopes of 12 to 20 percent; sandstone bedrock at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Elkmound: EmB, EmC2	Severe: shallow to sandstone bedrock.	Severe: shallow to sandstone bedrock; slope.	Severe: shallow to sandstone bedrock.	Severe: difficult to rip sandstone with light equipment.	Severe: shallow to sandstone bedrock.	Severe: depth to sandstone bedrock.
EmD2, EmE	Severe: slope; moderately deep to sandstone bedrock.	Severe: slope.	Severe: slope; shallow to sandstone bedrock.	Severe: slope.	Severe: shallow to sandstone bedrock.	Severe: depth to sandstone bedrock; slope.
Elm Lake: Eo	Severe: high water table.	Severe: high water table.	Severe: high water table; moderately deep to sandstone and shale.	Severe: high water table.	Severe: high water table; sandstone and shale bedrock.	Severe: high water table.
Ettrick: Er	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
*Fairchild: FmA, FmB. For Merrillan part, see Merrillan series.	Severe: seasonal high water table.	Severe: rapid permeability in upper part of subsoil; in places sandstone in substratum causes lateral seepage; seasonal high water table.	Severe: seasonal high water table; moderately deep to sandstone and shale.	Severe: seasonal high water table.	Severe: seasonal high water table; sandstone and shale bedrock; danger of lateral seepage.	Moderate: seasonal high water table; sandstone and shale bedrock.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Poor: shallow to platy sandstone bedrock.	Fair to poor: shallow to platy sandstone.	Poor: thin; shallow to sandstone bedrock.	Moderate permeability in subsoil; platy sandstone bedrock at a depth of 10 to 20 inches.	Medium shear strength; poor compaction characteristics; piping hazard; sandstone bedrock at a depth of 10 to 20 inches.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained; thin soil.	Slopes of 2 to 12 percent; sandstone bedrock at a depth of 10 to 20 inches.
Poor: shallow to platy sandstone bedrock; slope.	Fair to poor: shallow to platy sandstone.	Poor: slope; thin; shallow to sandstone bedrock.	Moderate permeability in subsoil; platy sandstone at a depth of 10 to 20 inches; steep.	Medium shear strength; poor compaction characteristics; piping hazard; sandstone bedrock at a depth of 10 to 20 inches.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained; thin soil; steep.	Slopes of 12 to 45 percent; sandstone bedrock at a depth of 10 to 20 inches; rock outcrops in places; difficult to vegetate in places.
Poor: high water table.	Poor: shale and sandstone bedrock; high water table.	Poor: sandy; high water table.	Moderately rapid permeability in upper part of subsoil; slow permeability in substratum; high water table.	Medium shear strength; fair to good compaction characteristics; piping hazard; sandstone and shale bedrock at a depth of 20 to 40 inches.	High water table; moderately rapid permeability in upper part of subsoil; slow permeability in lower part of subsoil and substratum; unstable when wet.	Low available water capacity; rapid intake rate; poorly drained; moderately deep soil.	Slopes of 0 to 2 percent; poorly drained; sandstone and shale bedrock at a depth of 20 to 40 inches.
Poor: high water table; moderate shrink-swell potential; susceptible to frost action.	Unsuited	Poor: high water table.	Moderately slow permeability; high water table.	Medium to low shear strength; fair to poor compaction characteristics; piping hazard.	High water table; moderately slow permeability; unstable when wet.	High available water capacity; moderate intake rate; very poorly drained; deep soil; temporary ponding in places.	Slopes of 0 to 2 percent; poorly drained to very poorly drained; temporary surface ponding.
Fair to poor: moderately deep to sandstone and shale bedrock; seasonal high water table.	Unsuited	Poor: sandy; thin; seasonal high water table.	Rapid permeability in upper part of subsoil; moderately slow permeability in lower part of subsoil; seasonal high water table; sandstone and shale at a depth of 20 to 40 inches.	Medium shear strength; fair to good compaction characteristics; piping hazard; sandstone and shale bedrock at a depth of 20 to 40 inches.	Seasonal high water table; moderately slow permeability; sandstone and shale bedrock at a depth of 20 to 40 inches; unstable when wet.	Low available water capacity; moderately rapid intake rate; somewhat poorly drained; moderately deep soil.	Slopes of 0 to 6 percent; somewhat poorly drained; sandstone and shale bedrock at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Fallcreek: FoA, FoB	Severe: seasonal high water table; moderately slow permeability.	Severe: moderately slow permeability in subsoil and substratum; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table; difficult to work; stones in places.	Severe: susceptible to frost action; seasonal high water table.
Fallcreek variant: FpB, FpC	Severe: seasonal high water table; moderately slow permeability.	Moderate if slopes are 2 to 6 percent; severe if slopes are 6 to 12 percent.	Moderate: seasonal high water table at a depth of 3 to 5 feet.	Moderate: seasonal high water table in places; danger of basement seepage.	Moderate: seasonal high water table in places; difficult to work; stones in places.	Moderate: susceptible to frost action.
Friendship: FrA	Severe: seasonal high water table.	Severe: rapid permeability.	Severe: low sidewall stability.	Moderate: seasonal high water table at a depth of 3 to 5 feet; danger of basement seepage.	Severe: rapid permeability; seasonal high water table.	Slight: moderately well drained.
Gale: GaB, GaC2	Moderate: [1] moderately deep to sandstone bedrock; slope.[2]	Severe: rapid permeability in substratum; slope.	Moderate: [3] moderately deep to sandstone bedrock.	Moderate: rippable sandstone bedrock in most places.	Severe: moderately deep to sandstone bedrock; rapid permeability in substratum.	Moderate: depth to sandstone bedrock; susceptible to frost action.
GaD2, GaE	Severe: slope; moderately deep to sandstone bedrock.	Severe: slope.	Severe: slope; moderately deep to sandstone bedrock.	Severe: slope; sandstone bedrock.	Severe: moderately deep to sandstone bedrock; rapid permeability in substratum; slope.	Severe: slope.
Gotham: GoB	Slight [2]	Severe: rapid permeability.	Severe: low sidewall stability.	Slight	Severe: rapid permeability.	Slight

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Poor: susceptible to frost action; seasonal high water table; unstable when wet; stones in places.	Unsuited	Good in surface layer. Poor in subsoil: seasonal high water table; stones in places.	Moderately slow permeability in subsoil and substratum; seasonal high water table; stones in places.	Medium to low shear strength; fair compaction characteristics; piping hazard.	Seasonal high water table; moderately slow permeability in subsoil and substratum; unstable when wet.	High available water capacity; moderate intake rate; somewhat poorly drained; deep soil.	Slopes of 0 to 6 percent; somewhat poorly drained; stones in places.
Fair: susceptible to frost action; unstable when wet; stones in places.	Poor: pockets of poorly graded sand and gravel in places.	Fair in surface layer: thin. Poor in subsoil: high clay content; difficult to work; stones in places.	Moderately slow permeability in subsoil and substratum; seasonal high water table at a depth of 3 to 5 feet; stones in places.	Low shear strength; fair compaction characteristics; piping hazard.	Natural drainage is adequate; seasonal high water table is at a depth of 3 to 5 feet for short periods.	High available water capacity; moderate intake rate; moderately well drained; deep soil.	Slopes of 2 to 12 percent; moderately well drained; stones in places.
Good	Good	Poor: sandy	Rapid permeability; seasonal high water table at a depth of 3 to 5 feet.	Medium to high shear strength; good compaction characteristics; piping hazard.	Natural drainage is adequate; seasonal high water table is at a depth of 3 to 5 feet for short periods.	Low available water capacity; rapid intake rate; moderately well drained; deep soil; hazard of soil blowing.	Slopes of 0 to 3 percent; moderately well drained; sandy; difficult to vegetate.
Fair: moderately deep to sandstone bedrock; susceptible to frost action.	Poor: mostly silt loam over sandstone.	Fair in surface layer: thin. Fair to poor in subsoil: thin over sandstone bedrock.	Moderate permeability in subsoil; rapid permeability in substratum; sandstone bedrock at a depth of 20 to 40 inches.	Medium to low shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil.	Slopes of 2 to 12 percent; sandstone bedrock at a depth of 20 to 40 inches.
Fair: moderately deep to sandstone bedrock; susceptible to frost action.	Poor: silt loam over sandstone in most places.	Poor: slope	Moderate permeability in subsoil; rapid permeability in substratum; sandstone bedrock at a depth of 20 to 40 inches; slope.	Medium to low shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil; slope.	Slopes of 12 to 30 percent; sandstone bedrock at a depth of 20 to 40 inches.
Good	Good: some fines in substratum in places.	Poor: sandy	Rapid permeability.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is somewhat excessive.	Low available water capacity; rapid intake rate; somewhat excessively drained; deep soil; hazard of soil blowing.	Slopes of 1 to 6 percent; sandy; difficult to vegetate.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Gotham—Continued						
GoC2	Moderate: slope [2]	Severe: slope; rapid permeability.	Severe: low sidewall stability.	Moderate: slope.	Severe: rapid permeability.	Moderate: slope.
GsB	Slight or moderate: [1] moderately deep to sandstone bedrock in places.[2]	Severe: rapid permeability.	Severe: low sidewall stability; moderately deep to sandstone bedrock in places.	Slight or moderate: sandstone bedrock is a concern in places.	Severe: rapid permeability; sandstone bedrock at a depth of 40 to 60 inches.	Slight
GsC2	Moderate: [1] slope; moderately deep to sandstone bedrock in places.[2]	Severe: slope; rapid permeability.	Severe: low sidewall stability; moderately deep to sandstone bedrock in places.	Moderate: sandstone bedrock is a concern in places.	Severe: rapid permeability; sandstone bedrock at a depth of 40 to 60 inches.	Moderate: slope.
*Hiles:						
HC2	Severe: seasonal high water table.	Severe: slope	Moderate: [3] moderately deep to sandstone and shale bedrock; seasonal high water table at a depth of 3 to 5 feet.	Moderate: seasonal high water table; danger of basement seepage; rippable sandstone and rippable shale in most places.	Moderate: rippable sandstone and shale bedrock in most places; seasonal high water table is a concern in places; danger of lateral seepage in places.	Moderate: depth to sandstone and shale bedrock; susceptible to frost action.
HkB For Kert part, see Kert series.	Severe: seasonal high water table.	Moderate or severe: seasonal high water table in places; danger of lateral seepage in shale and sandstone bedrock.	Moderate or severe: [3] seasonal high water table in places; moderately deep to sandstone and shale bedrock.	Moderate or severe: seasonal high water table ranges in depth from 1 to 5 feet; danger of basement seepage.	Severe: seasonal high water table; sandstone and shale bedrock.	Moderate: depth to sandstone and shale bedrock; susceptible to frost action.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Good	Good: some fines in substratum in places.	Poor: sandy	Rapid permeability.	Medium shear strength; fair to good compaction characteristics; piping hazard.	Natural drainage is somewhat excessive.	Low available water capacity; rapid intake rate; somewhat excessively drained; deep soil; sloping; hazard of soil blowing.	Slopes of 6 to 12 percent; sandy; difficult to vegetate.
Fair: underlain by sandstone bedrock.	Fair: loamy strata in places; sandstone bedrock.	Poor: sandy	Rapid permeability; sandstone bedrock at a depth of 40 to 60 inches.	Medium shear strength; fair to good compaction characteristics; piping hazard; sandstone bedrock at a depth of 40 to 60 inches.	Natural drainage is somewhat excessive.	Low available water capacity; rapid intake rate; somewhat excessively drained; deep soil; hazard of soil blowing.	Slopes of 2 to 6 percent; sandstone bedrock at a depth of 40 to 60 inches; sandy; difficult to vegetate.
Fair: underlain by sandstone bedrock.	Fair: loamy strata in places; sandstone bedrock.	Poor: sandy	Rapid permeability; sandstone bedrock at a depth of 40 to 60 inches.	Medium shear strength; fair to good compaction characteristics; piping hazard; sandstone bedrock at a depth of 40 to 60 inches.	Natural drainage is somewhat excessive.	Low available water capacity; rapid intake rate; somewhat excessively drained; deep soil; sloping; hazard of soil blowing.	Slopes of 6 to 12 percent; sandstone bedrock at a depth of 40 to 60 inches; sandy; difficult to vegetate.
Fair to poor: moderate shrink-swell potential; susceptible to frost action; moderately deep to sandstone and shale.	Unsuited	Good in surface layer. Poor in subsoil: clayey; thin over shale and sandstone.	Slow permeability in lower part of subsoil; seasonal high water table at a depth of 3 to 5 feet; sandstone and shale at a depth of 20 to 40 inches.	Medium to low shear strength; fair to good compaction characteristics; piping hazard; sandstone and shale bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate; seasonal high water table for short periods.	Moderate available water capacity; moderate intake rate; well drained and moderately well drained; moderately deep soil.	Slopes of 6 to 12 percent; well drained and moderately well drained; sandstone and shale bedrock at a depth of 20 to 40 inches.
Fair to poor: moderate shrink-swell potential; susceptible to frost action; moderately deep to sandstone and shale.	Unsuited	Fair in surface layer. Poor in subsoil: high clay content; thin over sandstone and shale bedrock; wet in places.	Moderate to slow permeability; seasonal high water table; sandstone and shale at a depth of 20 to 40 inches.	Medium to low shear strength; fair to good compaction characteristics; piping hazard; sandstone and shale bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate in some areas, other areas have high seasonal water table; sandstone and shale at a depth of 20 to 40 inches; unstable when wet.	Moderate available water capacity; moderate intake rate; well drained to somewhat poorly drained; moderately deep soil.	Slopes of 2 to 6 percent; well drained to somewhat poorly drained; sandstone and shale bedrock at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Hixton: HnB, HnC2	Moderate: [1] moderately deep to sandstone bedrock; slope.[2]	Severe: rapid permeability in substratum; moderately deep to sandstone bedrock.	Moderate: [3] moderately deep to sandstone bedrock.	Moderate: rippable sandstone in most places.	Severe: moderately deep to sandstone bedrock; rapid permeability in substratum.	Moderate: depth to sandstone bedrock.
HnD2	Severe: slope.	Severe: rapid permeability in substratum; moderately deep to sandstone bedrock; slope.	Severe: slope; moderately deep to sandstone bedrock.	Severe: slope; sandstone bedrock.	Severe: moderately deep to sandstone bedrock; rapid permeability in substratum.	Severe: slope.
Houghton: Ho	Severe: high water table.	Severe: high water table; organic material.	Severe: high water table; organic material unstable.	Severe: organic material unsuited for dwelling site; high water table.	Severe: organic material; high water table.	Severe: organic material; high water table.
Humbird Mapped only with Ludington soils.	Severe: seasonal high water table; moderately slow permeability.	Moderate if slopes are 0 to 6 percent; severe if slopes are more than 6 percent.	Moderate: [3] moderately deep to sandstone and shale bedrock; seasonal high water table at a depth of 3 to 5 feet.	Moderate: seasonal high water table; danger of basement seepage; rippable sandstone and rippable shale bedrock in most places.	Moderate: seasonal high water table; rippable sandstone and rippable shale in most places; danger of lateral seepage in places.	Moderate: moderate stability in subsoil; moderately deep to sandstone and shale.
Kert: KA	Severe: seasonal high water table; moderately slow permeability in substratum.	Moderate: sandstone in substratum allows lateral seepage in places.	Severe: seasonal high water table; moderately deep to sandstone and shale bedrock.	Severe: seasonal high water table.	Severe: seasonal high water table; sandstone and shale bedrock.	Moderate: depth to sandstone and shale bedrock; seasonal high water table.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair: moderately deep to sandstone bedrock.	Poor: fines in upper part; sandstone.	Fair in surface layer: thin. Poor in subsoil: thin over sandstone.	Moderate permeability in subsoil; rapid permeability in substratum; sandstone bedrock at a depth of 20 to 40 inches.	Medium to low shear strength; fair compaction characteristics; piping hazard; sandstone bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil.	Slopes of 2 to 12 percent; sandstone bedrock at a depth of 20 to 40 inches.
Fair: moderately deep to sandstone bedrock.	Poor: fines in upper part; sandstone.	Poor: slope	Moderate permeability in subsoil; rapid permeability in substratum; sandstone at a depth of 20 to 40 inches.	Medium to low shear strength; fair compaction characteristics; piping hazard; sandstone bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil; slope.	Slopes of 12 to 20 percent; sandstone bedrock at a depth of 20 to 40 inches.
Poor: organic material; high water table.	Unsuited	Poor: organic material; high water table.	Rapid permeability; high water table.	Unsuited: organic material.	High water table; rapid permeability; unstable when wet.	Very high available water capacity; rapid intake rate; very poorly drained; deep soil; hazard of soil blowing.	Generally not applicable; slopes of 0 to 2 percent; very poorly drained; organic material.
Fair: moderate shrink-swell potential; moderate stability; moderately deep to sandstone and shale; variable clay content.	Unsuited	Fair in surface layer: thin. Poor in subsoil: thin over sandy and clayey material.	Moderate permeability in upper part of subsoil, moderately slow permeability in lower part; seasonal high water table at a depth of 3 to 5 feet; sandstone and shale at a depth of 20 to 40 inches.	Medium shear strength; fair to good compaction characteristics; piping hazard; sandstone and shale at a depth of 20 to 40 inches.	Natural drainage is adequate; seasonal high water table for short periods.	Low available water capacity; moderate intake rate; well drained to moderately well drained; moderately deep soil.	Slopes of 2 to 12 percent; well drained to moderately well drained; sandstone and shale bedrock at a depth of 20 to 40 inches.
Poor: susceptible to frost action; unstable when wet; seasonal high water table.	Unsuited	Fair in surface layer. Fair to poor in subsoil: thin over sandstone and shale.	Moderately slow permeability in subsoil; moderate permeability in sandstone and shale substratum; seasonal high water table.	Medium to low shear strength; fair to good compaction characteristics; piping hazard; sandstone and shale bedrock at a depth of 20 to 40 inches.	Seasonal high water table; moderate to moderately slow permeability; sandstone and shale bedrock at a depth of 20 to 40 inches; unstable when wet.	Moderate available water capacity; moderate intake rate; somewhat poorly drained; moderately deep soil.	Slopes of 0 to 3 percent; somewhat poorly drained; sandstone and shale bedrock at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Lows: La	Severe: high water table.	Severe: high water table; rapid permeability in substratum.	Severe: high water table.	Severe: high water table; in places surface water is a concern for short periods.	Severe: high water table.	Severe: high water table.
*Ludington: LuB, LuC. For Humbird part, see Humbird series.	Severe: seasonal high water table; moderately deep to shale and sandstone bedrock.	Severe: rapid permeability in upper part of subsoil; sandstone in substratum can allow lateral seepage.	Moderate: [3] moderately deep to sandstone and shale bedrock; seasonal high water table at a depth of 3 to 5 feet.	Moderate: seasonal high water table; danger of basement seepage; rippable sandstone and rippable shale bedrock in most places.	Severe: sandy; danger of lateral seepage; sandstone and shale bedrock; seasonal high water table.	Slight if slopes are 2 to 6 percent; moderate if slopes are 6 to 12 percent; moderately deep to sandstone and shale bedrock; seeps and springs in places.
Markey: Ma	Severe: high water table.	Severe: high water table.	Severe: high water table; organic material and underlying sand unstable.	Severe: organic material unsuited for dwelling site; high water table.	Severe: organic material; high water table.	Severe: organic material; high water table.
Marshan: Mc	Severe: high water table.	Severe: high water table; rapid permeability in substratum.	Severe: high water table.	Severe: high water table; in places surface water is a concern for short periods.	Severe: high water table.	Severe: high water table.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Poor: high water table.	Fair: fines in substratum; high water table.	Fair in surface layer: thin. Poor in subsoil: thin over sand.	Moderate permeability in subsoil; rapid permeability in substratum; high water table.	Medium to low shear strength; fair to good compaction characteristics in subsoil; medium shear strength; good compaction characteristics in substratum; piping hazard.	High water table; moderate permeability in subsoil; rapid permeability in substratum; temporary ponding; unstable when wet.	Moderate available water capacity; moderate intake rate; poorly drained; moderately deep soil; temporary ponding.	Slopes of 0 to 2 percent; poorly drained; sand at a depth of 20 to 40 inches; temporary ponding.
Fair: moderately deep to sandstone and shale.	Unsuited	Poor: sandy; thin over sandstone and shale.	Rapid permeability in upper part of subsoil, moderately slow permeability in lower part; sandstone and shale at a depth of 20 to 40 inches.	Medium shear strength; fair to good compaction characteristics; piping hazard; sandstone and shale bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Low available water capacity; rapid intake rate; well drained to moderately well drained; moderately deep soil.	Slopes of 2 to 12 percent; well drained to moderately well drained; sandstone and shale bedrock at a depth of 20 to 40 inches; difficult to vegetate in places.
Poor: organic material; high water table.	Poor: variable underlying sand; organic material and high water table hinders excavation.	Poor: organic material; high water table.	Rapid permeability in organic material; rapid permeability in underlying sand; high water table.	Unsuitable organic matter; medium shear strength in sand substratum; good compaction characteristics; piping hazard.	Seasonal high water table; rapid permeability in organic matter; rapid permeability in underlying sand; unstable when wet.	High available water capacity; rapid intake rate; moderately thick organic material over sand; very poorly drained; hazard of soil blowing.	Generally not applicable; slopes of 0 to 2 percent; very poorly drained; organic material.
Poor: high water table.	Fair: thin strata of poorly graded sand and gravel in places; high water table.	Poor: high water table.	Moderate permeability in subsoil; rapid permeability in substratum; high water table.	Medium to low shear strength; fair to good compaction characteristics in subsoil; medium shear strength; good compaction characteristics in substratum; piping hazard.	High water table; moderate permeability in subsoil; rapid permeability in substratum; temporary ponding; unstable when wet.	Moderate available water capacity; moderate intake rate; poorly drained to very poorly drained; moderately deep soil; temporary ponding.	Slopes of 0 to 2 percent; poorly drained to very poorly drained; sand at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Menahga:						
MdB	Slight [2]	Severe: rapid permeability in substratum.	Severe: low sidewall stability.	Slight	Severe: rapid permeability.	Slight
MdC	Moderate: [2] slope.	Severe: slope.	Severe: low sidewall stability.	Moderate: slope.	Severe: rapid permeability.	Moderate: slope.
Meridian:						
MeA, MB	Slight [2]	Severe: rapid permeability in substratum.	Moderate: moderate sidewall stability.	Slight	Severe: rapid permeability in substratum.	Moderate in subsoil; slight in substratum.
MC2	Moderate: [2] slope.	Severe: slope.	Moderate: moderate sidewall stability; slope.	Moderate: slope.	Severe: rapid permeability in substratum.	Moderate: slope.
MmA	Severe: seasonal high water table.	Severe: rapid permeability in substratum.	Moderate: moderate sidewall stability; seasonal high water table at a depth of 3 to 5 feet.	Moderate: seasonal high water table; danger of basement seepage.	Severe: rapid permeability in substratum; seasonal high water table hinders excavation.	Moderate in subsoil; slight in substratum; in places seasonal high water table is a concern in the lower part of subsoil and substratum.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Good	Good	Poor: sandy	Rapid permeability.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive.	Very low available water capacity; rapid intake rate; excessively drained; deep soil; hazard of soil blowing.	Slopes of 1 to 6 percent; sandy; difficult to vegetate.
Good	Good	Poor: sandy	Rapid permeability.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive.	Very low available water capacity; rapid intake rate; excessively drained; deep soil; hazard of soil blowing.	Slopes of 6 to 12 percent; sandy; difficult to vegetate.
Fair in subsoil; good in substratum.	Good: some fines in substratum in places.	Fair in surface layer: thin. Fair to poor in subsoil: thin over sand.	Moderate permeability in subsoil; rapid permeability in substratum.	Medium to low shear strength; fair compaction characteristics in subsoil; medium shear strength; good compaction characteristics in substratum.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil.	Slopes of 0 to 6 percent; sand at a depth of 20 to 40 inches.
Fair in subsoil; good in substratum.	Good: some fines in substratum in places.	Fair in surface layer: slope; thin. Poor in subsoil: thin over sand.	Moderate permeability in subsoil; rapid permeability in substratum.	Medium to low shear strength; fair compaction characteristics in subsoil; medium shear strength; good compaction characteristics in substratum.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil; slope.	Slopes of 6 to 12 percent; sand at a depth of 20 to 40 inches.
Fair in subsoil; good in substratum.	Good: poorly graded sand substratum; some fines in places.	Fair in surface layer: slope; thin. Poor in subsoil: thin over sand; seasonal high water table.	Moderate permeability in subsoil; rapid permeability in substratum; seasonal high water table at a depth of 3 to 5 feet.	Medium to low shear strength; fair compaction characteristics in subsoil; medium shear strength; good compaction characteristics in substratum.	Natural drainage is adequate; seasonal high water table at a depth of 3 to 5 feet for short periods.	Moderate available water capacity; moderate intake rate; moderately well drained; moderately deep soil.	Slopes of 0 to 3 percent; moderately well drained; sand at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Merrillan Mapped only with Fairchild soils.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; moderately deep to sandstone and shale bedrock.	Severe: seasonal high water table.	Severe: seasonal high water table; sandstone and shale bedrock.	Moderate: seasonal high water table; depth to sandstone and shale bedrock.
Morocco: Mo	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; low sidewall stability.	Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Mt. Carroll: MrB, MrC2	Moderate: moderate permeability.	Moderate if slopes are 0 to 6 percent; moderate permeability; severe if slopes are more than 6 percent.	Slight if slopes are 0 to 6 percent; moderate if slopes are more than 6 percent.	Moderate: moderate stability and shear strength; danger of basement seepage for short periods.	Slight	Moderate: moderate shrink-swell potential; susceptible to frost action.
Ms	Moderate: [2] moderate permeability.	Moderate: moderate permeability.	Slight	Moderate: moderate stability and shear strength; danger of basement seepage for short periods.	Slight: sand below a depth of 40 inches in places.	Moderate: moderate shrink-swell potential; susceptible to frost action.
Newson: Ns	Severe: high water table.	Severe: high water table.	Severe: high water table; low sidewall stability.	Severe: high water table.	Severe: high water table.	Severe: high water table.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair to poor: moderate shrink-swell potential; seasonal high water table; variable clay content.	Unsuited	Fair in surface layer: thin. Poor in subsoil: thin over sandstone and shale.	Moderate permeability in upper part of subsoil, slow permeability in lower part of subsoil and substratum; seasonal high water table; sandstone and shale bedrock at a depth of 20 to 40 inches.	Medium to low shear strength; fair compaction characteristics; piping hazard; sandstone and shale bedrock at a depth of 20 to 40 inches.	Seasonal high water table; moderate permeability in upper part of subsoil; slow permeability in lower part of subsoil and substratum; sandstone and shale bedrock at a depth of 20 to 40 inches; unstable when wet.	Low available water capacity; moderate intake rate; somewhat poorly drained; moderately deep soil.	Slopes of 0 to 6 percent; somewhat poorly drained; sandstone and shale bedrock at a depth of 20 to 40 inches.
Moderate: seasonal high water table.	Good	Poor: sandy; seasonal high water table.	Rapid permeability; seasonal high water table.	Medium shear strength; good compaction characteristics; piping hazard.	Seasonal high water table; rapid permeability; substratum unstable.	Low available water capacity; rapid intake rate; somewhat poorly drained; deep soil.	Slopes of 0 to 2 percent; somewhat poorly drained; sandy; difficult to vegetate.
Fair: moderate shrink-swell potential; susceptible to frost action.	Unsuited	Fair in surface layer: thin. Fair in subsoil: firm consistency; difficult to work.	Moderate permeability in subsoil and substratum.	Medium shear strength in subsoil; fair compaction characteristics; low to medium shear strength in substratum; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate.	Very high available water capacity; moderate intake rate; well drained; deep soil.	Slopes of 2 to 12 percent.
Fair: moderate shrink-swell potential; susceptible to frost action.	Unsuited	Fair in surface layer: thin. Fair in subsoil: firm consistency; difficult to work.	Moderate permeability in subsoil and substratum; rapid permeability in sand below a depth of 40 inches in places.	Medium shear strength in subsoil; fair compaction characteristics; low to medium shear strength in substratum; fair to poor compaction characteristics; piping hazard.	Natural drainage is adequate.	Very high available water capacity; moderate intake rate; well drained; deep soil.	Slopes of 0 to 2 percent.
Poor: high water table.	Fair: high water table.	Poor: sandy; high water table.	Rapid permeability; high water table.	Medium shear strength; fair to good compaction characteristics; piping hazard.	High water table; rapid permeability; unstable when wet.	Low available water capacity; rapid intake rate; poorly drained.	Slopes of 0 to 2 percent; poorly drained; sandy; difficult to vegetate.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Norden: NrC2	Moderate: [1] slope.[2]	Severe: slope.	Moderate: [3] moderately deep to sandstone bedrock.	Moderate: rippable sandstone in most places.	Moderate: moderately deep to rippable sandstone in most places; danger of seepage in places.	Severe: moderately deep to sandstone bedrock.
NrD2, NrE2	Severe: slope.	Severe: slope.	Severe: slope; moderately deep to sandstone bedrock.	Severe: slope; moderately deep to sandstone bedrock.	Moderate to severe: moderately deep to rippable sandstone in most places; danger of seepage in places.	Severe: slope.
Northfield: NtB, NtC2	Severe: shallow to sandstone bedrock.	Severe: shallow to sandstone bedrock.	Severe: shallow to bedrock.	Severe: difficult to rip sandstone with light equipment.	Severe: shallow to sandstone bedrock.	Severe: shallow to platy sandstone bedrock.
NtD2, NtE2, NtF	Severe: shallow to sandstone bedrock; slope.	Severe: slope; shallow to sandstone bedrock.	Severe: shallow to bedrock; slope.	Severe: slope; sandstone bedrock.	Severe: shallow to sandstone bedrock; slope.	Severe: slope; depth to sandstone bedrock.
Orion: On	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair: moderately deep to sandstone.	Poor: mostly silt loam over sandstone; high in fines.	Fair in surface layer: thin. Poor in subsoil: shallow to sandstone bedrock.	Moderate permeability in subsoil; sandstone bedrock at a depth of 20 to 40 inches.	Medium to low shear strength; fair compaction characteristics; piping hazard; sandstone bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil; slope.	Slopes of 6 to 12 percent; sandstone bedrock at a depth of 20 to 40 inches.
Fair: moderately deep to sandstone; slope.	Poor: mostly silt loam over sandstone; high in fines.	Poor: slope; thin; subsoil thin over sandstone bedrock.	Moderate permeability in subsoil; sandstone bedrock at a depth of 20 to 40 inches; slope.	Medium to low shear strength; fair compaction characteristics; piping hazard; sandstone bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil; moderately steep to steep.	Slopes of 12 to 30 percent; sandstone bedrock at a depth of 20 to 40 inches.
Poor: shallow to platy sandstone bedrock.	Poor: shallow to platy sandstone bedrock.	Poor: shallow to platy sandstone bedrock.	Moderate permeability in subsoil; platy sandstone bedrock at a depth of 10 to 20 inches.	Medium shear strength; fair to good compaction characteristics; stones; sandstone bedrock at a depth of 10 to 20 inches.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained; thin soil.	Slopes of 2 to 12 percent; sandstone bedrock at a depth of 10 to 20 inches.
Poor: shallow to platy sandstone; slope.	Poor: shallow to platy sandstone.	Poor: slope; shallow to platy sandstone bedrock.	Moderate permeability in subsoil; platy sandstone bedrock at a depth of 10 to 20 inches; steep.	Medium shear strength; fair to good compaction characteristics; stones; sandstone bedrock at a depth of 10 to 20 inches.	Natural drainage is adequate.	Low available water capacity; moderate intake rate; well drained; thin soil; steep.	Slopes of 12 to 45 percent; sandstone bedrock at a depth of 10 to 20 inches; rock outcrops in places.
Poor: susceptible to frost action; seasonal high water table; subject to flooding.	Unsuited	Good: seasonal high water table; subject to flooding.	Moderate permeability; seasonal high water table; subject to flooding.	Medium to low shear strength; fair to poor compaction characteristics; piping hazard.	Seasonal high water table; moderate permeability; subject to flooding.	Very high available water capacity; moderate intake rate; somewhat poorly drained; deep soil; subject to flooding.	Slopes of 0 to 2 percent; somewhat poorly drained; subject to flooding.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Otter: Or	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.
Otterholt: OsB	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Slight	Slight	Severe: susceptible to frost action.
OsC2	Moderate: slope.	Severe: slope; moderate permeability.	Moderate: slope.	Moderate: slope.	Slight	Moderate: slope; low shrink-swell potential; susceptible to frost action.
Pillot: PcB	Slight [2]	Severe: rapid permeability in substratum.	Moderate: moderate sidewall stability.	Slight	Severe: rapid permeability in substratum.	Moderate in subsoil; slight in substratum.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Poor: high water table; subject to flooding.	Unsuited	Poor: high water table; subject to flooding.	Moderate permeability; high water table; subject to flooding.	Low to medium shear strength; fair to poor compaction characteristics; piping hazard.	High water table; moderate permeability; subject to flooding.	Very high available water capacity; moderate intake rate; poorly drained; deep soil; subject to flooding.	Slopes of 0 to 2 percent; poorly drained; subject to flooding.
Poor: low shrink-swell potential; susceptible to frost action.	Poor: pockets of poorly graded sand and gravel in substratum in places.	Good in surface layer. Fair in subsoil: firm consistency; difficult to work.	Moderate permeability in subsoil and substratum.	Medium to low shear strength in subsoil; fair to poor compaction characteristics; medium to low shear strength in substratum; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate.	Very high available water capacity; moderate intake rate; well drained; deep soil.	Slopes of 2 to 6 percent.
Fair: low shrink-swell potential; susceptible to frost action.	Poor: pockets of poorly graded sand and gravel in substratum in places.	Fair in surface layer: slope; thin. Fair in subsoil: firm consistency; difficult to work.	Moderate permeability in subsoil and substratum.	Medium to low shear strength in subsoil; fair to poor compaction characteristics; medium to low shear strength in substratum; fair to good compaction characteristics; piping hazard.	Natural drainage is adequate.	Very high available water capacity; moderate intake rate; well drained; deep soil; slope.	Slopes of 6 to 12 percent.
Fair in subsoil; good in substratum.	Good: poorly graded sand with some gravel in substratum in places; includes fines in places.	Fair in surface layer: thin. Poor in subsoil: thin over sand.	Moderate permeability in subsoil; rapid permeability in substratum.	Medium to low shear strength in subsoil; fair compaction characteristics; medium shear strength in substratum; good compaction characteristics; piping hazard.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil.	Slopes of 2 to 6 percent; sand at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Plainbo: PdB, PdC2	Moderate: [2] moderately deep to sandstone bedrock.[1]	Severe: rapid permeability.	Severe: [3] moderately deep to sandstone bedrock.	Moderate: rippable sandstone in most places.	Severe: sandy; rapid permeability; sandstone bedrock.	Slight if slopes are 2 to 6 percent; moderate if slopes are 6 to 12 percent; rippable sandstone in most places.
Plainfield: PfB	Slight [2]	Severe: rapid permeability.	Severe: low sidewall stability.	Slight	Severe: rapid permeability.	Slight
PfC2	Moderate: [2] slope.	Severe: slope; rapid permeability.	Severe: low sidewall stability.	Moderate: slope.	Severe: rapid permeability.	Moderate: slope.
PlB, PlC2	Moderate: [2] loamy bands in substratum restrict leaching.	Severe: rapid permeability; slope.	Severe: low sidewall stability.	Slight if slopes are 2 to 6 percent; moderate if slopes are 6 to 12 percent.	Severe: rapid permeability.	Slight if slopes are 2 to 6 percent; moderate if slopes are 6 to 12 percent.
Riverwash: Re	Severe: subject to flooding.	Severe: subject to flooding; rapid permeability.	Severe: subject to flooding; low sidewall stability.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Good: weakly cemented sandstone.	Good: weakly cemented sandstone.	Poor: sandy.	Rapid permeability; sandstone bedrock at a depth of 20 to 40 inches.	Medium shear strength; fair to good compaction characteristics; piping hazard; sandstone bedrock at a depth of 20 to 40 inches.	Natural drainage is excessive.	Very low available water capacity; rapid intake rate; excessively drained; moderately deep soil; hazard of soil blowing.	Slopes of 2 to 12 percent; sandstone bedrock at a depth of 20 to 40 inches; sandy; difficult to vegetate.
Good	Good	Poor: sandy.	Rapid permeability.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive.	Low available water capacity; rapid intake rate; excessively drained; deep soil; hazard of soil blowing.	Slopes of 1 to 6 percent; sandy; difficult to vegetate.
Good	Good	Poor: sandy.	Rapid permeability.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive.	Low available water capacity; rapid intake rate; excessively drained; deep soil; slope; hazard of soil blowing.	Slopes of 6 to 12 percent; sandy; difficult to vegetate.
Good	Fair; loamy.	Poor: sandy.	Rapid permeability; loamy bands in substratum.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive.	Low available water capacity; rapid intake rate; excessively drained; deep soil with loamy bands in substratum; hazard of blowing.	Slopes of 1 to 12 percent; sandy; difficult to vegetate.
Fair: variable sand and gravel content; subject to flooding.	Fair: variable sand and gravel content; often inaccessible.	Poor: sandy; subject to flooding.	Rapid permeability; subject to flooding.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive; subject to flooding.	Very low available water capacity; rapid intake rate; excessively drained; subject to flooding; hazard of soil blowing.	Generally not applicable; slopes of 0 to 2 percent; subject to frequent flooding; sandy; difficult to vegetate.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Seaton: SeB, SeC2	Moderate: moderate permeability.	Moderate if slopes are 2 to 6 percent; severe if slopes are 6 to 12 percent; moderate permeability.	Slight if slopes are 2 to 6 percent; moderate if slopes are steeper than 6 percent.	Moderate: moderate stability and shear strength; danger of basement seepage for short periods.	Slight	Moderate: susceptible to frost action.
SeD2, SeE2	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
SfB	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Moderate: moderate stability and shear strength; danger of basement seepage for short periods.	Slight: sand below a depth of 40 inches in places.	Moderate: susceptible to frost action.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair: susceptible to frost action.	Unsuited	Fair in surface layer: thin. Fair in subsoil: firm consistency; difficult to work.	Moderate permeability in subsoil and substratum.	Medium shear strength; fair compaction characteristics in subsoil; low to medium shear strength; fair to poor compaction characteristics in substratum; piping hazard.	Natural drainage is adequate.	Very high available water capacity; moderate intake rate; well drained; deep soil.	Slopes of 2 to 12 percent.
Fair: susceptible to frost action; slope.	Unsuited	Poor: slope	Moderate permeability in subsoil and substratum; slope.	Medium shear strength; fair compaction characteristics in subsoil; low to medium shear strength; fair to poor compaction characteristics in substratum; piping hazard.	Natural drainage is adequate.	Very high available water capacity; moderate intake rate; well drained; deep soil; moderately steep to steep.	Slopes of 12 to 30 percent.
Fair: susceptible to frost action.	Unsuited	Fair in surface layer: thin. Fair in subsoil: firm consistency; difficult to work.	Moderate permeability in subsoil and substratum; rapid permeability in sand below a depth of 40 inches in places.	Medium shear strength; fair compaction characteristics in subsoil; low to medium shear strength; fair to poor compaction characteristics in substratum; piping hazard.	Natural drainage is adequate.	Very high available water capacity; moderate intake rate; well drained; deep soil.	Slopes of 2 to 6 percent.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Seaton—Continued SmA, SmB	Severe: seasonal high water table.	Moderate: moderate permeability.	Moderate: seasonal high water table at a depth of 3 to 5 feet.	Moderate: moderate stability and shear strength; seasonal high water table; danger of basement seepage.	Slight: seasonal high water table is a concern in places.	Moderate: susceptible to frost action.
Shiffer: So	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table; moderate shrink-swell potential.
Sparta: SpB	Slight [2]	Severe: very rapid permeability.	Severe: low sidewall stability.	Slight	Severe: very rapid permeability.	Slight
Tell: TA, TB	Slight [2]	Severe: rapid permeability in substratum.	Moderate: moderate sidewall stability.	Slight	Severe: rapid permeability in substratum.	Moderate in subsoil; slight in substratum.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Fair: susceptible to frost action.	Unsuited	Fair in surface layer: thin. Fair in subsoil: firm consistency; difficult to work.	Moderate permeability in subsoil and substratum; seasonal high water table at a depth of 3 to 5 feet.	Medium shear strength; fair compaction characteristics in subsoil; low to medium shear strength; fair to poor compaction characteristics in substratum; piping hazard.	Natural drainage is adequate in most places; soil may remain saturated for short periods in places.	Very high available water capacity; moderate intake rate; moderately well drained; deep soil.	Slopes of 0 to 6 percent; moderately well drained.
Fair: moderate shrink-swell potential; susceptible to frost action; seasonal high water table.	Fair: some fines.	Fair in surface layer: thin. Poor in subsoil: thin over sand; seasonal high water table.	Moderate permeability in subsoil; rapid permeability in substratum; seasonal high water table.	Medium to low shear strength; fair to good compaction characteristics in subsoil; medium shear strength; good to fair compaction characteristics in substratum; piping hazard.	Seasonal high water table; moderate permeability in subsoil; rapid permeability in substratum; unstable when wet.	Moderate available water capacity; moderate intake rate; somewhat poorly drained; moderately deep soil.	Slopes of 0 to 2 percent; somewhat poorly drained; sand at a depth of 20 to 40 inches.
Good	Good	Poor: sandy	Very rapid permeability.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive.	Low available water capacity; rapid intake rate; excessively drained; deep soil; hazard of soil blowing.	Slopes of 1 to 6 percent; sandy; difficult to vegetate.
Fair in subsoil; good in substratum.	Good: sandy substratum can include some fines.	Fair in surface layer: thin. Fair to poor in subsoil: thin over sand.	Moderate permeability in subsoil; rapid permeability in substratum.	Medium to low shear strength; fair compaction characteristics in subsoil; medium shear strength; good compaction characteristics in substratum; piping hazard.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; well drained; moderately deep soil.	Slopes of 0 to 6 percent; sand at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Terrace escarpments, sandy: Tn	Severe: slope.	Severe: slope; rapid permeability.	Severe: low sidewall stability.	Severe: slope.	Severe: rapid permeability; sandy.	Slight.
Trempe: TrB	Slight [2]	Severe: rapid permeability.	Severe: low sidewall stability.	Slight.	Severe: rapid permeability.	Slight.
Urne: UnD2, UnE	Severe: slope.	Severe: slope.	Moderate: [3] moderately deep to sandstone bedrock.	Severe: slope; sandstone bedrock.	Moderate to severe: moderately deep to rippable sandstone bedrock in most places; some danger of seepage.	Severe: slope.
Veedum: Vd	Severe: high water table.	Moderate: high water table; moderately slow permeability; danger of lateral seepage.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Vesper: V	Severe: high water table.	Moderate: high water table; moderately slow permeability; danger of lateral seepage.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.

See footnotes at end of table.

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Good	Good	Poor: sandy; slope.	Rapid permeability; steep.	Medium shear strength; good to fair compaction characteristics; piping hazard.	Natural drainage is excessive.	Low available water capacity; rapid intake rate; excessively drained; steep.	Slopes of 12 to 45 percent; sandy; difficult to vegetate.
Good	Good	Poor: sandy	Rapid permeability.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive.	Low available water capacity; rapid intake rate; excessively drained; deep soil; hazard of soil blowing.	Slopes of 1 to 6 percent; sandy; difficult to vegetate.
Fair to poor: moderately deep to weakly cemented sandstone; susceptible to frost action; slope.	Poor: sandstone; high in fines.	Poor: thin; slope.	Moderate permeability in subsoil; sandstone bedrock at a depth of 20 to 40 inches; steep.	Medium to low shear strength; fair to poor compaction characteristics; piping hazard; sandstone bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Moderate available water capacity; moderate intake rate; somewhat excessively drained; moderately deep soil; moderately steep to steep.	Slopes of 12 to 45 percent; sandstone bedrock at a depth of 20 to 40 inches.
Poor: high water table.	Unsuited	Poor: high water table.	Moderately slow permeability; high water table.	Medium to low shear strength; fair to poor compaction characteristics; piping hazard; sandstone and shale bedrock at a depth of 20 to 40 inches.	High water table; moderately slow permeability; temporary ponding; sandstone and shale at a depth of 20 to 40 inches; unstable when wet.	Moderate available water capacity; slow intake rate; very poorly drained; moderately deep soil; temporary ponding.	Slopes of 0 to 2 percent; very poorly drained; sandstone and shale bedrock at a depth of 20 to 40 inches; temporary ponding.
Poor: high water table.	Unsuited	Poor: high water table.	Moderately slow permeability; high water table.	Medium to low shear strength; fair to poor compaction characteristics; piping hazard; sandstone and shale bedrock at a depth of 20 to 40 inches.	High water table; moderately slow permeability; sandstone and shale bedrock at a depth of 20 to 40 inches; unstable when wet.	Moderate available water capacity; slow intake rate; poorly drained; moderately deep soil.	Slopes of 0 to 2 percent; poorly drained; sandstone and shale bedrock at a depth of 20 to 40 inches.

TABLE 10.—*Engineering interpretations for*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill (trench type)	Local roads and streets
Vilas: VlB	Slight [2]	Severe: very rapid permeability.	Severe: low sidewall stability.	Slight	Severe: very rapid permeability.	Slight
Whitehall: Wh	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Slight	Slight	Moderate: susceptible to frost action.

[1] Where bedrock is unweathered, hard, or impermeable, the rating is severe.
[2] Poor filtering material; hazard of contaminating nearby water supplies.
[3] Moderately deep sandstone soils are usually excavated to a depth of 40 to 60 inches.

bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, slippage, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Engineering test data

Table 11 contains engineering test data for some of the major soil series in Eau Claire County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material. As was explained for table 9, the liquid limit is the moisture content at which the soil changes from a plastic state to a liquid state.

Formation and Classification of the Soils

This section consists of two main parts. In the first part the manner in which the factors of soil formation have affected the development of soils in Eau Claire County is described, and in the second part the system of soil classification currently used is explained, and each soil series of Eau Claire County is classified in that system.

The soil series in the county and a representative profile of each series are described in the section "Descriptions of the Soils."

Factors of Soil Formation

Soil is produced by soil forming processes acting on materials deposited or accumulated by geological agencies. The characteristics of the soil at any given point

town and country planning—Continued

Suitability as source of—			Soil features affecting—				
Roadfill	Sand	Topsoil	Pond reservoir areas	Dikes, levees and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Good	Good	Poor: sandy	Very rapid permeability.	Medium shear strength; good compaction characteristics; piping hazard.	Natural drainage is excessive.	Very low available water capacity; rapid intake rate; excessively drained; deep soil; hazard of soil blowing.	Slopes of 1 to 6 percent; sandy; difficult to vegetate.
Fair: susceptible to frost action.	Unsuited	Good in surface layer. Fair in subsoil: friable in upper part, firm below.	Moderate permeability; rapid permeability in lower part of substratum.	Medium to low shear strength, fair to poor compaction characteristics in subsoil; medium shear strength and fair to good compaction characteristics in substratum; piping hazard.	Natural drainage is adequate.	High available water capacity; moderate intake rate; well drained; deep soil.	Slopes of 0 to 2 percent.

[4] Source of gravel.
[5] Sandy or gravelly materials can be easily excavated, but have a severe hazard of sloughing.

are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil that has a characteristic profile. It may be much or little, but some time is always required for differentiation of soil horizons. Generally a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Common belief is that a combination of basic or simple processes takes place in all soils and is responsible for horizon differentiation. All of these processes are at least potential processes in every soil, and they generally do not act alone. These processes can be considered under four main headings: *gains, losses, transfers,* and *transformations.* Some of these changes promote horizon differentiation and others retard or offset it. The balance among changes determines the nature of the soil in any given area.

Soil morphology in Eau Claire County generally is expressed by prominent horizons within the solum. Differentiation of horizons in the county is the result of one or more of the following: gains in organic matter content, losses of carbonates and salts, transfers of silicate clay minerals, and transformation and transfer of iron.

In most of the soils, some organic matter has accumulated in the surface layer, but the quantity varies. Boone and Plainbo soils, for example, have a thin surface layer that is relatively low in organic matter content, but such soils as Dakota, Pillot, and Sparta soils have a thick, dark colored surface layer that is naturally high in organic matter content. Much of the organic matter is in the form of humus.

TABLE 11.—*Engineering*

[Tests by State Department of Transportation of Wisconsin in accordance with standard test procedures of the American

Soil name and location	Parent material	Depth from surface	Moisture density [1]	
			Maximum dry density	Optimum moisture
		Inches	*Pounds per cubic foot*	*Percent*
Arenzville silt loam:				
200 feet north and 100 feet west of the SE corner of SE¼ sec. 11, T. 26 N., R. 8 W. (Modal)	Silty alluvium.	8–28	----------	----------
		28–39	----------	----------
		39–60	112.1	15.8
Curran silt loam:				
1,200 feet west and 1,250 feet north of the SE corner of SW¼ sec. 9, T. 26 N., R. 7 W. (Modal)	Eolian and silty sediment.	22–34	----------	----------
		44–60	----------	----------
Seaton silt loam:				
500 feet south and 300 feet east of the NW corner of sec. 10, T. 26 N., R. 8 W. (Modal)	Eolian silt.	12–34	----------	----------
		38–60	----------	----------
Shiffer loam:				
700 feet north and 300 feet west of the SE corner of NE¼ sec. 6, T. 27 N., R. 10 W. (Modal)	Loamy and sandy outwash.	14–26	----------	----------
		30–60	----------	----------
Vesper silt loam:				
1,200 feet north and 850 feet east of the SE corner of the NW¼ sec. 34, T. 25 N., R. 5 W. (High sand content in subsoil)	Silty sediment and residuum from sandstone and shale.	17–26	----------	----------
		26–33	----------	----------

[1] Based on AASHTO Designation T99-57, Method A (*1*).

[2] Mechanical analyses according to the AASHTO Designation T88-57 (*1*). Results by this procedure may differ somewhat from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure the fine material is analyzed by hydrometer method, and the various grain size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculation of grain size fractions. The mechanical analyses data used in this table are not suitable for use in naming textural classes of soil.

Leaching of carbonates and salts has occurred in nearly all of the soils. Its visible effect on horizon differentiation has been limited, but it has had an indirect effect in facilitating the translocation of silicate clay minerals. Free carbonates and salts have been almost completely removed from some of the well drained soils. Even in the wettest soils through which water moves slowly, some leaching is indicated by the absence of free carbonates.

In many soils in the county the translocation and subsequent accumulation of silicate clay minerals in the lower part of the solum has contributed to the development of horizons. Soils of the Gale, Norden, and Seaton series have an accumulation of clay in the subsoil. The subsoil in these soils contains more clay than the horizons above or below. The clay contributes to the formation of blocky structure (aggregates) and most commonly occurs as thin films on the surface of the blocks.

Soils such as Gotham with less total clay have only clay bridging between individual sand grains as evidence of accumulation of silicate clays. Other soils, such as Fallcreek that have a high clay content and an accumulation of clay in the subsoil, have clay films on the surface of the blocks. In some profiles these soils have clay flows in pores, cracks, stone voids, and in the lining of openings left by plants roots, worms, and insects.

Soils such as Arenzville that formed in recently deposited sediment and soils such as Boone that are low in weatherable minerals have undergone little development. They exhibit no significant translocation and accumulation of silicate clays. These soils have little or no horizon differentiation.

The subsurface horizon from which clay has been removed has a bleached appearance and has platy structure.

The reduction and transfer of iron has occurred in all of the mineral soils that are very poorly drained, poorly drained, and somewhat poorly drained. In these naturally wet soils, this process, called gleying, is important in the differentiation of horizons. It is most pronounced in such very poorly drained soils as Ettrick and Marshan. These soils have a gray subsoil indicating both reduction and loss of iron oxides. Along with gleying, iron has been segregated in the subsoil of wet soils to form yellow, brown, and reddish mottles. In places manganese has been segregated into small dark brown or black spots. In a few places the iron is so segregated that concretions have formed.

test data

Association of State Highway (and Transportation) Officials (AASHTO) (*1*). Dashes indicate that no determination was made]

Mechanical analysis [2]						Liquid limit [3]	Plasticity index [4]	Classification	
Percentage less than 3 inches passing sieve—			Percentage smaller than—					AASHTO [5]	Unified [6]
No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
						Percent			
100	100	99	96	22	14	31	5	A-4(8)	ML
100	99	95	90	19	13	44	9	A-5(9)	ML
100	100	97	92	24	21	30	8	A-4(8)	CL
100	99	92	84	21	18	29	6	A-4(8)	ML
100	96	76	69	18	14	----------	[7] NP	A-4(8)	ML
100	100	93	85	24	21	33	10	A-4(8)	CL
100	100	96	90	22	18	32	8	A-4(8)	ML
100	89	56	51	23	20	27	11	A-6(4)	CL
100	91	20	15	5	4	----------	NP	A-2-4(0)	SM
100	90	43	39	17	13	20	6	A-4(2)	SC-SM
100	90	59	56	26	21	32	13	A-6(6)	CL

[3] Based on AASHTO Designation T89-60 (*1*).
[4] Based on AASHTO Designation T90-56 and AASHTO Designation T91-54 (*1*).
[5] Based on AASHTO Designation M145-49 (*1*).
[6] Based on ASTM Designation D2487-66 T (*2*).
[7] Nonplastic.

In most soils the substratum and underlying bedrock are little affected by soil forming processes.

Parent material

The soils of Eau Claire County formed in a number of different kinds of parent material. Most important is loess, which consists mostly of silt. The soils also formed in loamy glacial till; in disintegration products of underlying shale and sandstone; and in loamy and sandy material washed from slopes, transported by streams, and deposited on stream terraces and bottom lands. Some of the deposition on bottom lands and terraces originated as glacial outwash from areas of glacial drift both inside and outside of the county.

Loess deposits, where present, range from a few inches to about 10 feet in thickness, but in much of the county they are about 20 to 40 inches thick. Loess is thickest on nearly level to sloping uplands and stream terraces from the southern edge of the county into the south central part near the villages of Fallcreek and Augusta. A small isolated area of thick loess is in the northeastern part of the county near the settlement of Ludington. Silty Seaton soils are extensive in these areas. Other soils that formed in thick loess deposits are Curran, Mt. Carroll, Otterholt, and the Whitehall variant. Dells, Pillot, and Tell soils on stream terraces formed in loess and the underlying sandy alluvium. Gale, Hiles, Norden, and Veedum soils are on nearly level to steep uplands. These moderately deep, silty soils have a surface layer and subsoil that extend partly into residuum derived from underlying sandstone and shale. Northfield soils formed in 10 to 20 inches of loess and residuum derived from sandstone.

Arland, Cable, Fallcreek, and Fallcreek variant soils formed in loamy glacial till in nearly level to moderately steep landscape. Cable, Fallcreek, and Fallcreek variant soils formed in glacial deposits more than 40 inches thick. Arland soils formed in 20 to 40 inches of loamy glacial till and sandy residuum derived from underlying sandstone.

Residuum weathered from sandstone and shale was the parent material for a number of soils that are extensive in the county. Among these soils are nearly level to very steep, loamy and sandy Boone, Eleva, Elkmound, Fairchild, Hixton, Humbird, Kert, Ludington, Merrillan, Plainbo, Urne, and Vesper soils.

Au Gres, Billett, Burkhardt, Chetek, Dakota, Dunnville, Elm Lake, Friendship, Gotham, Lows, Marshan, Menahga, Meridian, Morocco, Newson, Plainfield,

Shiffer, Sparta, Trempe, and Vilas soils formed on stream terraces and outwash plains in 10 to 40 inches of loamy or sandy deposits over sand. Arenzville, Orion, and Otter soils and Alluvial land, sandy, and Alluvial land, wet, formed in stream bottoms in loamy and sandy sediment from recent stream deposits. Caryville and Ettrick soils formed in alluvium in slightly higher positions on the landscape where there is little or no active stream deposition.

In basins and depressions that were formerly shallow bodies of water, the parent material consists of partly decomposed plant remains. Adrian, Houghton, and Markey soils formed in this organic material.

Relief and drainage

Relief affects depth, organic matter content, and drainage of soils, and thus influences soil formation. Steep soils in Eau Claire County generally are shallower than less sloping soils because of gravitational movement and the erosion of soil particles downslope. Also, because of more rapid drainage on steep soils, the available moisture for soil forming processes is reduced and soils develop more slowly and are generally thinner.

Although some of the moderately deep and deep soils formed in areas where slopes are steep, a typical toposequence relating soil depth to slope is expressed in such soils as Elkmound, Northfield, Gale, and Seaton. The shallow Elkmound and Northfield soils are dominantly in areas where slopes are steep, and the moderately deep Gale soils and deep Seaton soils are progressively less sloping. Elkmound and Northfield soils have less clay accumulated in the subsoil than Gale and Seaton soils.

The clay content in the subsoil varies directly with slope, even within the same series. For example, gently sloping Seaton soils have a slightly higher clay content in the subsoil than moderately steep Seaton soils. Differences in slope and elevation of the land surface in Eau Claire County affect drainage, and this in turn determines some soil colors and organic matter content. Curran soils, for example, formed in loess as did Seaton soils, but because they are in flat or nearly depressed areas, Curran soils have various colored mottles because of the slow internal drainage. Ettrick soils formed in wet depressions where conditions were favorable for the development of a thick, black surface layer which is high in organic matter content. These soils also have a gray (gleyed) subsoil because of wetness.

Plant and animal life

Plant life and animal life contribute to soil formation chiefly through vegetative cover and organic matter accumulation. Bacteria, fungi, earthworms, rodents, and man also are important contributors to soil formations. Two of the chief effects of plant and animal life on soil formation are increased organic matter content and movement of plant nutrients in plant roots from lower to upper horizons. Soil structure and porosity are also partly the result of plant and animal life.

In Eau Claire County vegetation is a major factor in determining differences among soils. For example, soils that have a thick, dark colored surface layer, such as Dakota, Pillot, and Sparta, formed under a cover of grass. Soils that have a thinner or lighter colored surface layer formed under a cover of trees. Typical soils that formed under forest vegetation are Boone, Gale, Plainbo, and Seaton.

In the long cultivated soils of the county, man, as a component of the biological factor, has brought about sufficient changes from the original soils to require separate interpretation and classification. These changes include alteration in reaction and fertility of acid soils following liming, perpetuation of grassland vegetation in normally wooded areas through repeated grass fires, humus losses through improper cropping and tillage practices, and accelerated erosion following persistent removal of plant cover on terrace and upland fields. Arenzville soils formed as a result of cultivation and erosion of upland and terrace soils. As these soils were eroded, sediment was deposited on earlier soils on flood plains and stream bottoms. This deposition formed a soil consisting of 20 to 40 inches of recently deposited alluvium over a dark colored buried soil.

Climate

Climate affects soil formation both directly and indirectly through the moisture (precipitation) and heat energy (temperature) it contributes to the environment. The most important direct effects of climate are on the weathering of rocks and the alteration of parent materials. The indirect effects are generally of equal or greater significance. For instance, as precipitation increases and the temperature rises, the clay content of the soil tends to increase. Climate also affects formation indirectly by providing energy and a suitable environment for organisms. This is of special significance in the accumulation of organic matter and improvement of fertility.

Warmer, arid climates are generally more favorable for grass vegetation than trees. In Eau Claire County small extensions of warmer areas from the south and from microclimate regions account for prairie type soils that have a thick, dark colored surface layer. Dakota, Dunnville, and Sparta are examples of soils that formed under grass vegetation. Cool, humid climates are generally more favorable for such plants as hardwood trees. Soils that formed under forest vegetation have lighter colored or thinner surface layers than soils that formed under grass vegetation. Gale and Seaton soils are typical of soils that formed under forest vegetation.

Climate within the county is modified locally by variations in relief. For example, the formation of shallow soils such as Elkmound can be attributed mostly to rainwater that drains from steep slopes. Less water penetrates and remains in the steeper soils to furnish moisture for plant growth, microbiological activity, rock disintegration, and weathering. Climate is also modified by direction (aspect) of slope. South and west facing slopes are warmer and drier than north and east facing slopes. Consequently, more rainfall

evaporates on the south and west slopes, and less moisture is available for weathering of soil material. The trend of vegetation on the warmer and drier slopes is toward grass, and the trend on north and east slopes is toward trees. Although this trend is not of major significance in influencing the pattern of soils in Eau Claire County, its influence is apparent in sandy and skeletal soils.

Time

Time is required by the active agents of soil development to form soils from parent material. Some soils form rapidly, and others form slowly. The length of time required for a particular kind of soil to form depends on the other factors of soil formation involved. Time, therefore, never acts as an independent factor.

When soil formation began, the soil, or what we now speak of as the solum, had characteristics identical to those of the parent material. Even today some soils in the county show little, if any, profile development because of their recent deposition. Among such immature soils are those of the Arenzville and Orion series. These soils are along streams, and their parent material has been deposited recently in relation to most parent materials in the county. In these soils little, if any, horizon development has taken place, although there may be some strata. Over a long period of time these soils may go through successive stages of immaturity, maturity, and old age.

A soil is mature when it has well developed, distinct horizons and is nearly in equilibrium with its existing environment. At this time the soil factors no longer effect changes in soil material. Seaton soils are a good example of soils that are mature in their existing environment. In undisturbed forest cover, these soils exhibit all the major horizons that soil forming processes have had adequate time to develop. A thin surface layer (A1) is present and is relatively high in organic matter content; a platy, elluviated, lighter colored subsurface layer (A2) is present; a firm, blocky, illuviated subsoil (Bt) that contains more clay than horizons above or below is in the profile; and the underlying parent material is massive (structureless) silt loam.

Soils in Eau Claire County are in all stages of development. This points out that not all components expressed by soil forming processes mature at the same rate. Appraising the stage of maturity of a given soil is extremely difficult, because there is no reliable method of determining accurately when a soil is in equilibrium with its environment.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*26, 29*).

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 12 the soil series of Eau Claire County are placed in three categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

Order.—Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

Suborder.—Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of water-logging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is Aquept (*Aqu,* meaning water or wet, and *ept* from Inceptisol).

Great group.—Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark colored surface horizons. The features used are the self mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark red and dark brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplaquepts (*Hapl,* meaning simple horizons, *aqu,* meaning water or wet, and *ept,* from Inceptisol).

TABLE 12.—*Classification of the soils*

Series	Family	Subgroup	Order
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic	Terric Medisaprists	Histosols.
Alluvial land, sandy [1]		Udipsamments	Entisols.
Alluvial land, wet [1]		Fluvaquents	Entisols.
Arenzville	Coarse-silty, mixed, nonacid, mesic	Typic Udifluvents	Entisols.
Arland	Fine-loamy over sandy or sandy-skeletal, mixed	Eutric Glossoboralfs	Alfisols.
Au Gres	Sandy, mixed, frigid	Entic Haplaquods	Spodosols.
Billett	Coarse-loamy, mixed, mesic	Mollic Hapludalfs	Alfisols.
Boone	Mesic, uncoated	Typic Quartzipsamments	Entisols.
Burkhardt	Sandy, mixed, mesic	Typic Hapludolls	Mollisols.
Cable [2]	Coarse-loamy, mixed, nonacid, frigid	Typic Haplaquepts	Inceptisols.
Caryville	Sandy, mixed	Fluventic Haploborolls	Mollisols.
Chetek	Coarse-loamy, mixed	Eutric Glossoboralfs	Alfisols.
Curran	Fine-silty, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Dakota	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Argiudolls	Mollisols.
Dells	Fine-silty over sandy or sandy-skeletal, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Dunnville	Coarse-loamy, mixed	Udic Haploborolls	Mollisols.
Eleva	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Elkmound	Loamy, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Elm Lake	Sandy over loamy, mixed, acid, frigid	Typic Haplaquents	Entisols.
Ettrick	Fine-silty, mixed, mesic	Typic Argiaquolls	Mollisols.
Fairchild	Sandy over loamy, mixed, frigid	Aqualfic Haplorthods	Spodosols.
Fallcreek	Fine-loamy, mixed	Aquic Glossoboralfs	Alfisols.
Fallcreek variant	Fine-loamy, mixed	Typic Glossoboralfs	Alfisols.
Friendship	Mixed, frigid	Typic Udipsamments	Entisols.
Gale	Fine-silty over sandy or sandy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Gotham	Sandy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
Hiles	Fine-loamy, mixed	Typic Glossoboralfs	Alfisols.
Hixton	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Houghton	Euic, mesic	Typic Medisaprists	Histosols.
Humbird	Coarse-loamy over clayey, mixed, frigid	Alfic Haplorthods	Spodosols.
Kert	Fine-loamy, mixed	Aquic Glossoboralfs	Alfisols.
Lows	Fine-loamy over sandy or sandy-skeletal, mixed, nonacid, frigid.	Mollic Haplaquepts	Inceptisols.
Ludington	Sandy over loamy, mixed, frigid	Alfic Haplorthods	Spodosols.
Markey	Sandy or sandy-skeletal, mixed, euic	Terric Borosaprists	Histosols.
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Haplaquolls	Mollisols.
Menahga	Mixed, frigid	Typic Udipsamments	Entisols.
Meridian	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Mollic Hapludalfs	Alfisols.
Merrillan	Coarse-loamy over clayey, mixed, frigid	Aqualfic Haplorthods	Spodosols.
Morocco	Mixed, mesic	Aquic Udipsamments	Entisols.
Mt. Carroll [3]	Fine-silty, mixed, mesic	Mollic Hapludalfs	Alfisols.
Newson	Mixed, frigid	Humaqueptic Psammaquents	Entisols.
Norden	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Northfield	Loamy, mixed, mesic	Lithic Hapludalfs	Alfisols.
Orion	Coarse-silty, mixed, nonacid, mesic	Aquic Udifluvents	Entisols.
Otter	Fine-silty, mixed, mesic	Cumulic Haplaquolls	Mollisols.
Otterholt	Fine-silty, mixed	Typic Glossoboralfs	Alfisols.
Pillot [4]	Fine-silty over sandy or sandy-skeletal, mixed, mesic	Typic Argiudolls	Mollisols.
Plainbo	Mixed, frigid	Typic Udipsamments	Entisols.
Plainfield	Mixed, mesic	Typic Udipsamments	Entisols.
Riverwash [5]			
Seaton [6]	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Shiffer	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Sparta [7]	Sandy, mixed, mesic	Entic Hapludolls	Mollisols.
Tell	Fine-silty over sandy or sandy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Terrace escarpments, sandy [1]		Udipsamments	Entisols.
Trempe	Sandy, mixed, mesic	Entic Hapludolls	Mollisols.
Urne	Coarse-loamy, mixed, mesic (shallow)	Dystric Eutrochrepts	Inceptisols.
Veedum	Fine-loamy over sandy or sandy-skeletal, mixed, acid, frigid.	Typic Humaquepts	Inceptisols.
Vesper	Fine-loamy over sandy or sandy-skeletal, mixed, acid, frigid.	Humic Haplaquepts	Inceptisols.
Vilas	Sandy, mixed, frigid	Entic Haplorthods	Spodosols.
Whitehall variant	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.

[1] Land type, classified only to the subgroup level.

[2] These soils are taxadjunct to the series because they have a redder hue than that in the defined range of the series.

[3] These soils are taxadjunct to the series because they are more acid in the lower part of the subsoil and in the substratum than is defined in the range of the series.

[4] These soils are taxadjunct to the series because they contain less clay in the subsoil and are more acid than is defined in the range of the series.

[5] This land type too variable to classify.

[6] These soils are taxadjunct to the series because they are more acid in the lower part of the subsoil and in the substratum than is defined in the range of the series.

[7] These soils are taxadjunct to the series because they contain more medium and coarse sand than is defined in the range of the series.

Subgroup.—Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Hapludalfs (typical Hapludalfs).

Family.—Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae [table 12]. An example is the coarse-loamy, mixed, mesic family of Mollic Hapludalfs.

Environmental Factors Affecting Soil Use

Presented in this section is information about the chief natural and cultural features that affect the use and management of the soils of Eau Claire County. Those features that affect the existing and potential use of soils for farming and other purposes are stressed.

Natural Features

Relief and drainage, geology, climate, water supply, and natural (climax) vegetation are important natural features that influence the use and management of the soils in Eu Claire County. Each of these is discussed in the paragraphs that follow.

Relief and drainage

Eau Claire County consists of two physiographic areas. The first is a broad lowland in the north and central parts that makes up about 34 percent of the county. The second area is a more sloping upland that makes up the rest of the county. The highest elevation is 1,290 feet above sea level. The difference in elevation between the lowest point in the county and the highest point is about 400 feet. The land surface of the county ranges from nearly level to very steep. Adjacent to the Eau Claire and Chippewa Rivers are extensive areas of nearly level and gently sloping soils. Moderately steep and very steep soils are throughout the county, but they are mainly in the southwestern part.

The drainage system is well developed. The Chippewa River, the largest stream in the county, has a valley that is as much as 1 mile wide and is bordered by sandy terraces about 80 feet high. The Eau Claire River is the longest river in the county. It enters the county at the eastern border and flows west to the city of Eau Claire where it connects with the Chippewa River. Tributaries of these rivers extend far into the uplands of the county. Four artificial lakes were formed by damming the Eau Claire and Chippewa Rivers. Also, a natural lake is in the city of Eau Claire.

Geology

The geology of Eau Claire County consists of thin loamy glacial deposits, variable depths of sandy and loamy stream sediment, and thin to deep windborne deposits over Cambrian sandstone. The southwestern corner of the county is within the boundary of the driftless area. In a few places the creeks and rivers have cut through the sandstone to the underlying crystalline rock.

Climate [6]

The climate of Eau Claire County is typically continental with warm summers and cold winters. The area is in the zone of frequent midlatitude storms. Spring and fall are commonly short and are generally periods of sharp temperature transitions.

The data in tables 13 and 14 are based on records (1930–59) at the city of Eau Claire and are fairly representative of the county as a whole. The minimum temperatures throughout the county sometimes vary considerably. Such factors as topography, soil type, or calm, clear nights can affect temperatures locally. The temperatures in marsh areas or in areas of organic soils can be expected to be several degrees cooler because of cool air drainage from the surrounding higher elevations.

Table 13 presents temperature and precipitation data. It also provides the average heating degree days by month (*27*). The degree day is the difference between the average temperature for a given day and 65° F. It is a measure of the amount of heat needed to keep the temperature on a specific day at 65° F. For example, on a day having an average temperature of 50° F, 15 degree days would be counted. A knowledge of the accumulated degree days for a given period is helpful in calculating the amount of fuel needed to heat a building or determining the rate of growth and maturity date of crops.

Nearly two-thirds of the annual precipitation falls in the 5 months of the growing season from May through September. Soil moisture is generally adequate for the first part of the growing season, but after June, crops depend on rain that falls mostly from thunderstorms and tends to be erratic and variable. Yearly snowfall ranges from less than 12 inches to more than 75 inches. Snow covers the ground for the greater part of the winter. Precipitation intensities of about 1.25 inches in one hour, 2.20 inches in 6 hours, and 2.70 inches in 24 hours can be expected about once in two years. The greatest amount of rain to be recorded in 24 hours was 4.62 inches that fell on May 26, 1899.

[6] By MARVIN W. BURLEY, former climatologist for Wisconsin, National Weather Service, U.S. Department of Commerce.

TABLE 13.—*Temperature and precipitation data*

[All data from Eau Claire. Based on records for the period 1930-59]

Month	Temperature							Average heating-degree-days [2]	Precipitation		
	Average daily maximum	Average daily minimum	Average monthly	Maximum number of days with 90° F and above [1]	Maximum number of days with 32° F and above [1]	Minimum number of days with 32° F and below [1]	Minimum number of days with 0° F and below [1]		Average total	Average snow and sleet	Days with 0.1 inch or more
	°F	°F	°F						*Inches*	*Inches*	
January	24.4	6.3	15.4	0	22	30	11	1,540	0.96	8.4	3
February	28.4	8.7	18.5	0	17	28	8	1,300	1.03	8.6	3
March	39.1	20.3	29.7	0	8	28	2	1,090	1.78	9.7	5
April	56.6	34.5	45.6	(3)	1	14	0	580	2.77	1.8	6
May	70.7	47.0	58.9	1	0	2	0	250	3.65	0.2	7
June	80.0	57.3	68.7	5	0	0	0	70	4.52	0	8
July	85.7	62.2	74.0	9	0	0	0	0	3.34	0	6
August	83.2	59.9	71.6	7	0	0	0	20	3.93	0	7
September	73.3	50.4	31.9	2	0	1	0	150	3.39	0	6
October	60.9	39.2	50.1	0	(3)	7	0	460	2.03	0.4	4
November	41.5	25.0	63.3	0	7	23	1	950	1.77	4.3	4
December	23.8	12.7	20.8	0	19	30	6	1,370	1.03	7.5	3
Year	56.0	35.3	45.7	24	74	163	28	7,780	30.20	40.9	62

[1] Figures represent mean number of days.

[2] Base 65° F.

[3] Less than one-half day.

TABLE 14.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Eau Claire]

Probability	Dates for given probability and temperature				
	32° F or lower	28° F or lower	24° F or lower	20° F or lower	16° F or lower
Spring:					
20 percent chance after	May 15	May 2	April 19	April 10	April 2
40 percent chance after	May 8	April 25	April 11	April 3	March 26
60 percent chance after	May 2	April 18	April 5	March 27	March 20
80 percent chance after	April 25	April 11	March 28	March 19	March 12
Fall:					
20 percent chance before	September 24	October 7	October 20	October 28	November 3
40 percent chance before	October 1	October 15	October 27	November 4	November 11
60 percent chance before	October 7	October 21	November 3	November 11	November 18
80 percent chance before	October 14	October 29	November 11	November 18	November 26

Thunderstorms occur on an average of 35 days per year. About two-thirds of these storms are in June, July, and August. The number of days per year that have thunderstorms ranges from 20 to 45. The number of days that have hail averages 2 per year, but the range is 0 to 8 days per year.

Wind, sunshine, and humidity measurements are not available at the climatological station in the city of Eau Claire, but records from Minneapolis closely approximate conditions at the station. Prevailing winds are from the northwest in winter and from the south and southeast in summer. They average 11 miles per hour in winter and 9 miles per hour in summer. The windiest month is April, with an average of nearly 13 miles per hour. Only 40 percent of the possible sunshine occurs in November and December, but nearly 70 percent of the possible sunshine occurs from July through September. In winter the relative humidity ranges from an average of 70 percent during the afternoon to 80 percent at night. In summer the relative humidity averages 55 percent in the afternoon to a little more than 80 percent at night.

Table 14 shows the probability of the last freezing temperatures in spring and the first in fall. The aver-

age date of the last 32 degree freeze in spring is May 5, and the first in fall is October 4. The growing season, defined as the number of days between the last 32 degree freeze in spring and the first in fall, averages 151 days. The term "growing season" can be misleading, however, because different crops have different temperatures at which growth is affected. Also, the minimum temperatures vary considerably across Eau Claire County on calm, clear nights, depending on such physical characteristics as topography, soil characteristics, and proximity to open water.

Water supply

No formal ground water studies are known to exist for Eau Claire County, so the information contained in this section is general and based on known data from other counties.

The crystalline rock that forms the bedrock floor of Eau Claire County generally does not yield water to wells, but it does control the dip of the sedimentary rock formations that lie on top of it and thus indirectly influences ground water levels. Sandstone of the Cambrian age overlies the crystalline rock and is the principal bedrock aquifer in Eau Claire County. Yields to properly constructed wells commonly range from 500 to 1,000 gallons per minute. When this aquifer is thin, the yield may diminish, ranging from 100 to 500 gallons or less per minute.

Glacial deposits which overlie the bedrock are also aquifers, but water availability from these deposits differs greatly within a small area. The best glacial drift aquifiers are thick sand and gravel outwash deposits. Clays and silts that were deposited in glacial lakes restrict water movement and are not good aquifers. Yields to wells in glacial drift range from 5 to about 100 gallons per minute, depending on the thickness and permeability of the glacial deposits.

Glacial drift aquifers are the principal source of ground water discharge to streams in Eau Claire County. The aquifers are recharged by rainfall that averages approximately 30 inches per year. Seasonal and long term climatic variations cause fluctuations in both streamflow and ground water levels.

Natural vegetation

At the time of settlement, most of Eau Claire County was wooded. Conifers, oak, maple, and elm were common trees in lowland areas. Conifers were in many sandy areas along major streams and on a few sandy upland ridges. Oak, maple, elm, and, to lesser extent, basswood were common trees in the upland areas. Pulpwood is one of the more important wood products of the forests of Eau Claire County (fig. 13).

A few small valleys, such as Bear Grass, Fall Creek, Thompson Creek, and West Creek, originally were partly covered by native grasses.

Cultural Features

Transportation, schools, and industries in Eau Claire County are discussed in the following paragraphs. Though cultural, these environmental factors are an important influence—either indirectly or directly—on soil use.

***Figure 13.*—Mixed hardwood and conifer pulpwood taken from an area of Ludington and Humbird soils.**

Transportation and schools

Eau Claire County's transportation facilities are provided by two railroads, an airline, and an extensive system of highways and roads.

The Chicago and Northwest Railroad provides freight service to the cities of Eau Claire and Augusta and the villages of Fall Creek and Fairchild. The Chicago, Milwaukee, St. Paul, and Pacific Railroad runs south from the city of Eau Claire and connects with the Chicago, Burlington, and Quincy Railroad at Bluff Siding (about 40 miles south of the city of Eau Claire). North Central Airlines provides passenger service to major cities in the State as well as to Minneapolis and St. Paul. There are about 170 miles of Federal and State highways and about 985 miles of county and town roads in the county. Interstate Highway I–94 crosses the southwestern corner of the county and connects with four State and Federal highways near the city of Eau Claire.

The University of Wisconsin at Eau Claire and a State vocational and technical school are located in the city of Eau Claire. In 1973 the former had an enrollment of 8,084 students, and the latter had an enrollment of 1,937 day students and 1,800 night students.

Industry

Most of the industries of the county are located in the city of Eau Claire. The largest single industry produces tires and employs about 2,545 persons. Most of the other industries, except for a milk bottling and dairy products manufacturing plant, are not closely related to farming.

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Glossary

Acidity. See "Reaction, soil."

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

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 pebbles or cobbles. In some blowouts the water table is exposed.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil

formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

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.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock , that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. 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 mixed with mineral soil material. The content of organic matter is more than 20 percent.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is nei-

ther acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

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.

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.

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.

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.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Terrace, outwash. See "Outwash, glacial."

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. In referring to a capability unit, a woodland suitability group or any other group, read the introduction to the section it is in for general information about its management.

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group	Wildlife group	Recreation group	Tree and shrub group
			Symbol	Page	Number	Number	Number	Number
Ad	Adrian muck	9	IVw-7	66	3w3	8	8	4
Ae	Alluvial land, sandy	11	VIIs-9	68	3s1	3	7	2
Af	Alluvial land, wet	11	Vw-14	67	4w2	7	7	3
ArA	Arenzville silt loam, 0 to 3 percent slopes	11	IIw-11	62	2o1	9	7	1
AtB	Arland sandy loam, 2 to 6 percent slopes	12	IIIs-4	64	2o1	1	2	2
AtC2	Arland sandy loam, 6 to 12 percent slopes, eroded	12	IIIe-7	63	2o1	1	2	2
AtD2	Arland sandy loam, 12 to 20 percent slopes, eroded	12	IVe-7	66	2r1	1	2	2
Au	Au Gres loamy sand	13	IVw-5	66	3s2	6	5	3
BlB	Billett sandy loam, 1 to 6 percent slopes	14	IIIs-4	64	3o1	1	2	2
BlC2	Billett sandy loam, 6 to 12 percent slopes, eroded	14	IIIe-7	63	3o1	1	2	2
BlD2	Billett sandy loam, 12 to 20 percent slopes, eroded	14	IVe-7	66	3r1	1	2	2
BmA	Billett sandy loam, moderately well drained, 0 to 3 percent slopes	14	IIIs-4	64	3o1	1	2	2
BoB	Boone-Plainbo complex, 2 to 6 percent slopes	15	VIIs-9	68	3s1	3	4	2
BoC	Boone-Plainbo complex, 6 to 12 percent slopes	15	VIIs-9	68	3s1	3	4	2
BoE	Boone-Plainbo complex, 12 to 45 percent slopes	16	VIIs-9	68	3s3	3	4	2
BuA	Burkhardt sandy loam, 0 to 3 percent slopes	16	IIIe-3	63	3d1	4	3	2
Cb	Cable loam	17	IIIw-3	64	3w2	7	6	3
CeA	Caryville loam, 0 to 3 percent slopes	17	IIIw-12	64	3o1	9	3	2
CkB	Chetek sandy loam, 1 to 6 percent slopes	18	IIIe-3	63	3d1	4	3	2
CkC2	Chetek sandy loam, 6 to 12 percent slopes, eroded	18	IVe-3	65	3d1	4	3	2
CkD2	Chetek sandy loam, 12 to 20 percent slopes, eroded	18	VIe-3	68	3d2	4	3	2
Cu	Curran silt loam	19	IIw-2	61	3o2	6	5	3
DaA	Dakota loam, 0 to 3 percent slopes	20	IIs-1	62	Not placed	5	1	1
De	Dells silt loam	20	IIw-5	62	3o2	6	5	3
DuA	Dunnville sandy loam, 0 to 3 percent slopes	21	IIIs-4	64	3o1	1	2	2
ElB	Eleva sandy loam, 2 to 6 percent slopes	22	IIIs-4	64	3o1	1	2	2
ElC2	Eleva sandy loam, 6 to 12 percent slopes, eroded	22	IIIe-7	63	3o1	1	2	2
ElD2	Eleva sandy loam, 12 to 20 percent slopes, eroded	22	IVe-7	66	3r1	1	2	2
EmB	Elkmound loam, 2 to 6 percent slopes	22	IIIe-3	63	3d1	4	3	2
EmC2	Elkmound loam, 6 to 12 percent slopes, eroded	23	IVe-3	65	3d1	4	3	2

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group	Wildlife group	Recreation group	Tree and shrub group
			Symbol	Page	Number	Number	Number	Number
EmD2	Elkmound loam, 12 to 20 percent slopes, eroded	23	VIe-3	68	3d2	4	3	2
EmE	Elkmound loam, 20 to 45 percent slopes	23	VIIe-3	68	3d2	4	3	2
Eo	Elm Lake loamy sand	24	IVw-5	66	4w1	7	6	3
Er	Ettrick silt loam	24	IIw-1	61	4w2	7	6	3
FmA	Fairchild and Merrillan soils, 0 to 2 percent slopes	25	IIIw-6	64	3s2	6	5	3
FmB	Fairchild and Merrillan soils, 2 to 6 percent slopes	25	IIIw-6	64	3s2	6	5	3
FoA	Fallcreek sandy loam, 0 to 2 percent slopes	26	IIw-4	62	2o2	6	5	3
FoB	Fallcreek sandy loam, 2 to 6 percent slopes	26	IIw-4	62	2o2	6	5	3
FpB	Fallcreek loam, moderately well drained variant, 2 to 6 percent slopes	27	IIe-1	60	2o2	1	1	1
FpC	Fallcreek loam, moderately well drained variant, 6 to 12 percent slopes	27	IIIe-1	62	2o2	1	1	1
FrA	Friendship loamy sand, 0 to 3 percent slopes	28	IVs-3	67	3s1	3	4	2
GaB	Gale silt loam, 2 to 6 percent slopes	29	IIe-2	60	2o1	1	1	1
GaC2	Gale silt loam, 6 to 12 percent slopes, eroded	29	IIIe-2	63	2o1	1	1	1
GaD2	Gale silt loam, 12 to 20 percent slopes, eroded	29	IVe-2	65	2r1	1	1	1
GaE	Gale silt loam, 20 to 30 percent slopes	29	VIe-2	67	2r1	1	1	1
GoB	Gotham loamy sand, 1 to 6 percent slopes	30	IVs-3	67	3s1	3	4	2
GoC2	Gotham loamy sand, 6 to 12 percent slopes, eroded	30	IVs-3	67	3s1	3	4	2
GsB	Gotham loamy sand, sandstone substratum, 2 to 6 percent slopes	30	IVs-3	67	3s1	3	4	2
GsC2	Gotham loamy sand, sandstone substratum, 6 to 12 percent slopes, eroded	30	IVs-3	67	3s1	3	4	2
HeC2	Hiles silt loam, 6 to 12 percent slopes, eroded	31	IIIe-6	63	2o1	1	1	1
HkB	Hiles and Kert soils, 2 to 6 percent slopes	31	IIe-6	61	2o1	---	5	---
	Hiles part	--	-------	--	---	1	---	1
	Kert part	--	-------	--	---	6	---	3
HnB	Hixton loam, 2 to 6 percent slopes	32	IIe-2	60	2o1	1	1	1
HnC2	Hixton loam, 6 to 12 percent slopes, eroded	32	IIIe-2	63	2o1	1	1	1
HnD2	Hixton loam, 12 to 20 percent slopes, eroded	32	IVe-2	65	2r1	1	1	1
Ho	Houghton muck	33	IVw-9	67	3w3	8	8	4
KeA	Kert loam, 0 to 3 percent slopes	34	IIw-3	61	2o2	6	5	3
La	Lows loam	35	IIw-5	62	3w2	7	6	3
LuB	Ludington and Humbird soils, 2 to 6 percent slopes	35	IIIe-3	63	3s1	1	2	2

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group	Wildlife group	Recreation group	Tree and shrub group
			Symbol	Page	Number	Number	Number	Number
LuC	Ludington and Humbird soils, 6 to 12 percent slopes	36	IVe-3	65	3s1	1	2	2
Ma	Markey muck	36	IVw-7	66	3w3	8	8	4
Mc	Marshan loam	37	IIw-5	62	4w2	7	6	3
MdB	Menahga sand, 1 to 6 percent slopes	38	VIIs-9	68	3s1	3	4	2
MdC	Menahga sand, 6 to 12 percent slopes	38	VIIs-9	68	3s1	3	4	2
MeA	Meridian loam, 0 to 2 percent slopes	39	IIs-1	62	2o1	1	1	1
MeB	Meridian loam, 2 to 6 percent slopes	39	IIe-2	60	2o1	1	1	1
MeC2	Meridian loam, 6 to 12 percent slopes, eroded	39	IIIe-2	63	2o1	1	1	1
MmA	Meridian loam, moderately well drained, 0 to 3 percent slopes	39	IIs-1	62	2o1	1	1	1
Mo	Morocco loamy sand	40	IVw-5	66	3s2	6	5	3
MrB	Mt. Carroll silt loam, 2 to 6 percent slopes	41	IIe-1	60	2o1	1	1	1
MrC2	Mt. Carroll silt loam, 6 to 12 percent slopes, eroded	41	IIIe-1	62	2o1	1	1	1
Ms	Mt. Carroll silt loam, benches	41	I-1	60	2o1	1	1	1
Na	Newson loamy sand	42	IVw-5	66	4w1	7	6	3
NrC2	Norden silt loam, 6 to 12 percent slopes, eroded	43	IIIe-2	63	2o1	1	1	1
NrD2	Norden silt loam, 12 to 20 percent slopes, eroded	43	IVe-2	65	2r1	1	1	1
NrE2	Norden silt loam, 20 to 30 percent slopes, eroded	43	VIe-2	67	2r1	1	1	1
NtB	Northfield silt loam, 2 to 6 percent slopes	44	IIIe-3	63	3d1	4	3	2
NtC2	Northfield silt loam, 6 to 12 percent slopes, eroded	44	IVe-3	65	3d1	4	3	2
NtD2	Northfield silt loam, 12 to 20 percent slopes, eroded	44	VIe-3	68	3d2	4	3	2
NtE2	Northfield silt loam, 20 to 30 percent slopes, eroded	44	VIIe-3	68	3d2	4	3	2
NtF	Northfield silt loam, 30 to 45 percent slopes	44	VIIe-3	68	3d3	4	3	2
On	Orion silt loam	45	IIw-11	62	3o2	6	7	3
Or	Otter silt loam, overwash	46	IIw-1	61	2w1	7	7	3
OsB	Otterholt silt loam, 2 to 6 percent slopes	47	IIe-1	60	1o1	1	1	1
OsC2	Otterholt silt loam, 6 to 12 percent slopes, eroded	47	IIIe-1	62	1o1	1	1	1
PcB	Pillot silt loam, 2 to 6 percent slopes	47	IIe-2	60	Not placed	5	1	1
PdB	Plainbo loamy sand, 2 to 6 percent slopes	48	IVs-3	67	3s1	3	4	2
PdC2	Plainbo loamy sand, 6 to 12 percent slopes, eroded	48	VIs-3	68	3s1	3	4	2
PfB	Plainfield loamy sand, 1 to 6 percent slopes	49	IVs-3	67	3s1	3	4	2
PfC2	Plainfield loamy sand, 6 to 12 percent slopes, eroded	49	VIs-3	68	3s1	3	4	2

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group	Wildlife group	Recreation group	Tree and shrub group
			Symbol	Page	Number	Number	Number	Number
PlB	Plainfield loamy sand, loamy substratum, 1 to 6 percent slopes	49	IVs-3	67	3o1	3	4	2
PlC2	Plainfield loamy sand, loamy substratum, 6 to 12 percent slopes, eroded	50	IVs-3	67	3o1	3	4	2
Re	Riverwash	50	VIIIs-10	69	6s1	10	7	2
SeB	Seaton silt loam, 2 to 6 percent slopes	51	IIe-1	60	1o1	1	1	1
SeC2	Seaton silt loam, 6 to 12 percent slopes, eroded	51	IIIe-1	62	1o1	1	1	1
SeD2	Seaton silt loam, 12 to 20 percent slopes, eroded	51	IVe-1	65	1r1	1	1	1
SeE2	Seaton silt loam, 20 to 30 percent slopes, eroded	51	VIe-1	67	1r1	1	1	1
SfB	Seaton silt loam, benches, 2 to 6 percent slopes	51	IIe-1	60	1o1	1	1	1
SmA	Seaton silt loam, moderately well drained, 0 to 2 percent slopes	51	I-1	60	1o1	1	1	1
SmB	Seaton silt loam, moderately well drained, 2 to 6 percent slopes	52	IIe-1	60	1o1	1	1	1
So	Shiffer loam	52	IIw-5	62	3o2	6	5	3
SpB	Sparta loamy sand, 1 to 6 percent slopes	53	IVs-3	67	3s1	3	4	2
TeA	Tell silt loam, 0 to 2 percent slopes	54	IIs-1	62	2o1	1	1	1
TeB	Tell silt loam, 2 to 6 percent slopes	54	IIe-2	60	2o1	1	1	1
Tn	Terrace escarpments, sandy	54	VIIs-9	68	4s2	3	4	2
TrB	Trempe loamy sand, 1 to 6 percent slopes	54	IVs-3	67	3s1	3	4	2
UnD2	Urne very fine sandy loam, 12 to 20 percent slopes, eroded	55	IVe-2	65	3r1	1	1	1
UnE	Urne very fine sandy loam, 20 to 45 percent slopes	55	VIIe-2	68	3r1	1	1	1
Vd	Veedum silt loam	56	IVw-3	66	5w5	7	6	3
Ve	Vesper loam	56	IIIw-3	64	5w5	7	6	3
VlB	Vilas sand, 1 to 6 percent slopes	57	VIIs-9	68	4s1	3	4	2
Wh	Whitehall silt loam, deep variant	58	I-1	60	Not placed	5	1	1

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