SOIL SURVEY OF

Wayne County Area, Michigan

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Michigan Agricultural Experiment Station

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.

Major fieldwork for this soil survey was completed in the period 1971–73. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the Michigan Agricultural Experiment Station. It is part of the technical assistance furnished to the Wayne Soil and Water Conservation District. The Wayne County Board of Commissioners furnished financial assistance. The County of Wayne shall not be liable for damages arising from errors, omissions, or inaccuracies appearing in this soil survey.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; 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 Wayne County Area 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 unit and woody plant group to which the soil has been assigned. It also shows the page where each soil is described and the page where each capability unit is described.

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 placed 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 interpretive groupings.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Engineers and builders can find, under "Engineering," tables that contain estimates of soil properties and information about soil features that affect engineering practices. They can find additional information in the section "Community Development."

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Wayne County 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 section "Environmental Factors Affecting Soil Use."

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Cover: Typical landscape of Metamora sandy loam and Pewamo loam in the western part of Wayne County. Land use change from farmland to housing developments is a common scene in many areas of Wayne County.

Issued November 1977

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SOIL SURVEY OF WAYNE COUNTY AREA, MICHIGAN

BY JERRY D. LARSON, SOIL CONSERVATION SERVICE

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH MICHIGAN AGRICULTURAL EXPERIMENT STATION

WAYNE COUNTY is in the southeastern part of Michigan (fig. 1). It has a land area of 388,480 acres, or 607 square miles. The survey area is 232,460 acres, or 363 square miles. The rest of the county, in and around Detroit, is so developed in housing and industry that making a detailed soil survey was not practical. Detroit, the county seat, is one of the largest industrial centers in the Midwest and headquarters for the automobile industry of the nation. In 1970 the population of the county was 2,670,368.

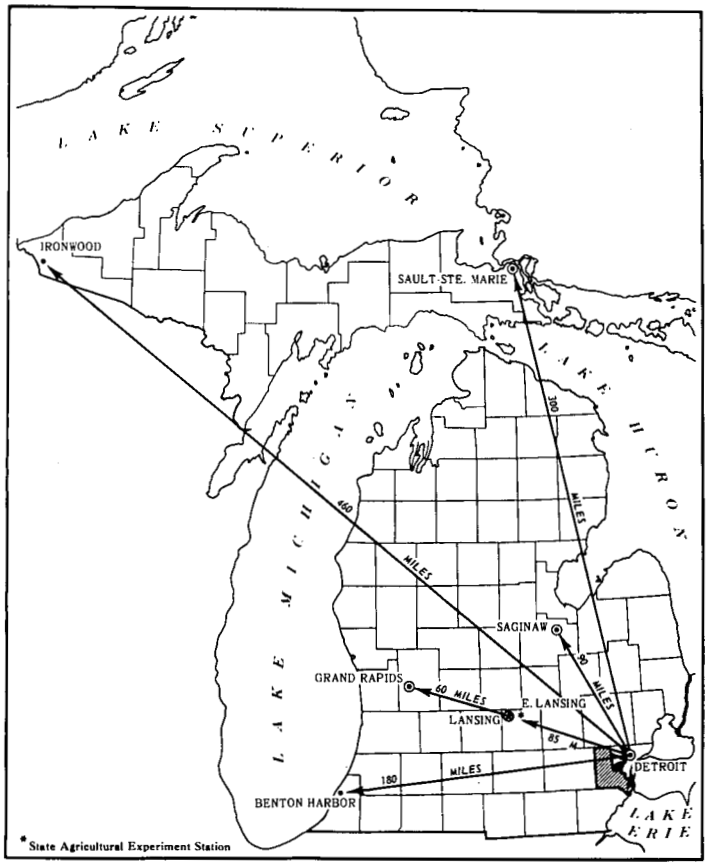

Figure 1.—**Location of Wayne County Area in Michigan.**

Although large parts of the county are industrial and urban, much of the western half of the county is still undeveloped. Such varied land use as further urban development, farming, specialty crops, sod production, and recreation are competing for this undeveloped area. The major farm crops are corn and soybeans. Some owners of small land units use their acreage to produce such urban oriented specialty crops as sweet corn, lettuce, tomatoes, and other table vegetables. Pasture is another important land use in Wayne County, since the county and this area have one of the largest horse populations in the State.

How This Survey Was Made

Soil scientists made this survey to determine what kinds of soil are in Wayne County Area, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and nature of streams; the kinds of native plants or crops; the kinds of geologic material; and many facts about the soils (fig. 2). 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 to 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 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* is the category of soil classification most used in a local survey *(5)*.[1]

Soils that have profiles that are 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 geographic feature near the place

[1] Italic numbers in parentheses refer to Literature Cited, p. 79.

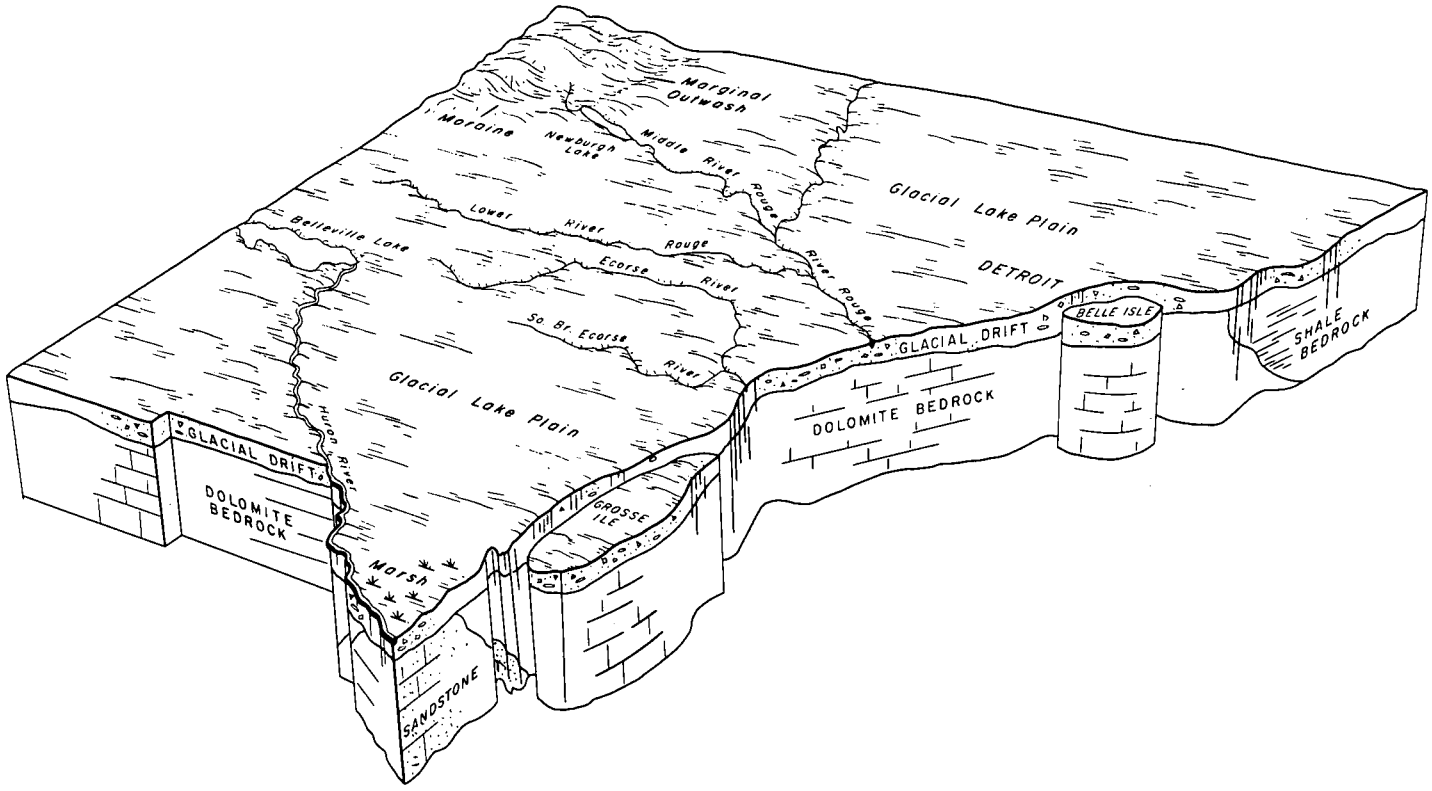

Figure 2.—**Physiography and drainage in Wayne County Area, Michigan.**

where a soil of that series was first observed and mapped. Boyer and Thetford, for example, are the names of two soil 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, Morley loam, 6 to 12 percent slopes, is one of several phases within the Morley 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. One such mapping unit, the soil complex, is shown on the soil map of Wayne County Area.

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 patterns 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. Selfridge-Pewamo complex, 0 to 2 percent slopes, is an example.

In most areas surveyed, there are places where the soil material has been so drastically altered by man and places where soil mapping is so unfeasible that the soil material 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. Made land is a land type in Wayne County Area.

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 soils.

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, community planners, 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 they 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 Wayne County. The unshaded part of the map has been generalized from the mapping units shown on the detailed maps in the survey. The shaded part is within the Detroit metropolitan area. Much of the soil in this area has been disturbed by earthmoving activities or is covered with buildings, streets, and parking lots. This part of the map was delineated on the basis of information from geologic maps, old soil maps, and recent soil mapping on parks and other small open areas. Therefore, the information in the shaded part is not so reliable, but it can be used to predict the kinds of soil conditions that will be encountered.

A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern or proportion.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of broad land use. Such a map is not suitable for planning the management of a farm or the development of a small area, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their use.

The eight soil associations in Wayne County are described in the following paragraphs.

1. *Wasepi-Gilford-Boyer association*

Nearly level to sloping, very poorly drained, somewhat poorly drained, and well drained soils that have a coarse textured or moderately coarse textured subsoil

The landscape in this soil association is one of nearly level to sloping outwash plains and deltas that are dissected by streams and creeks.

This soil association is all within the unshaded part of the general soil map. It occupies about 24,000 acres or about 10 percent of the area. About 50 percent is Wasepi soils, 25 percent Gilford soils, 15 percent Boyer soils, and 10 percent minor soils (fig. 3).

Wasepi soils are nearly level and are somewhat poorly drained. The surface layer typically is very dark brown loamy sand about 9 inches thick. The subsoil is about 6 inches of yellowish brown, very friable loamy sand mottled with very dark grayish brown; about 11 inches of yellowish brown, friable sandy loam mottled with grayish brown; and about 2 inches of grayish brown, very friable sandy loam mottled with yellowish brown. Grayish brown, slightly effervescent gravelly sand is at a depth of about 28 inches.

Gilford soils are nearly level and are very poorly drained. The surface layer typically is very dark gray sandy loam about 10 inches thick. The subsoil is about 8 inches of gray, very friable sandy loam mottled with yellowish brown and very dark gray; about 7 inches of grayish brown, friable sandy loam mottled with yellowish brown; and about 13 inches of light gray, very friable loamy sand. Grayish brown, slightly effervescent gravelly sand is at a depth of 38 inches.

Boyer soils are nearly level to sloping and are well drained. The surface layer typically is dark grayish brown loamy sand about 9 inches thick. The subsoil is about 9 inches of dark brown, very friable heavy loamy sand; about 8 inches of reddish brown, friable sandy clay loam; and about 3 inches of yellowish brown, loose gravelly loamy sand mottled with brown. Grayish brown, slightly effervescent gravelly sand is at a depth of about 29 inches.

Among the minor soils in this association are Corunna, Granby, Metamora, and Tedrow soils and the Wasepi loamy substratum soil. The minor soils are dominantly at the same position on the landscape as the nearly level Wasepi, Gilford, and Boyer soils. Some are lower.

Soils in this association are suited to crops commonly grown in the county. Permeability is moderately rapid, and available water capacity is low. The content of organic matter is moderate in Wasepi soils, high in Gilford, and low in Boyer. The main concerns of management are controlling soil blowing, removing excess water, conserving soil moisture in midsummer, and maintaining fertility. An additional concern is maintaining the organic-matter content in Boyer soils.

This association is used mainly for corn, small grain, pasture, hay, and various truck crops in farming areas and for homesites, industrial and commercial developments, recreational areas, airports, and roads near villages and cities. A few areas of undrained soils are wooded and are used as wildlife habitat. The main farm enterprises are cash crops and some dairying.

2. *Pewamo-Blount-Metamora association*

Nearly level to gently sloping, very poorly drained to somewhat poorly drained soils that have a fine textured to moderately coarse textured subsoil

The landscape in this soil association is one of nearly level to gently sloping lake plains and low moraines that are dissected by streams and creeks.

This soil association occupies about 38,000 acres or 16 percent of the unshaded part of the general soil map and about 53,000 acres or 34 percent of the shaded part. About 25 percent is Pewamo soils, 20 percent

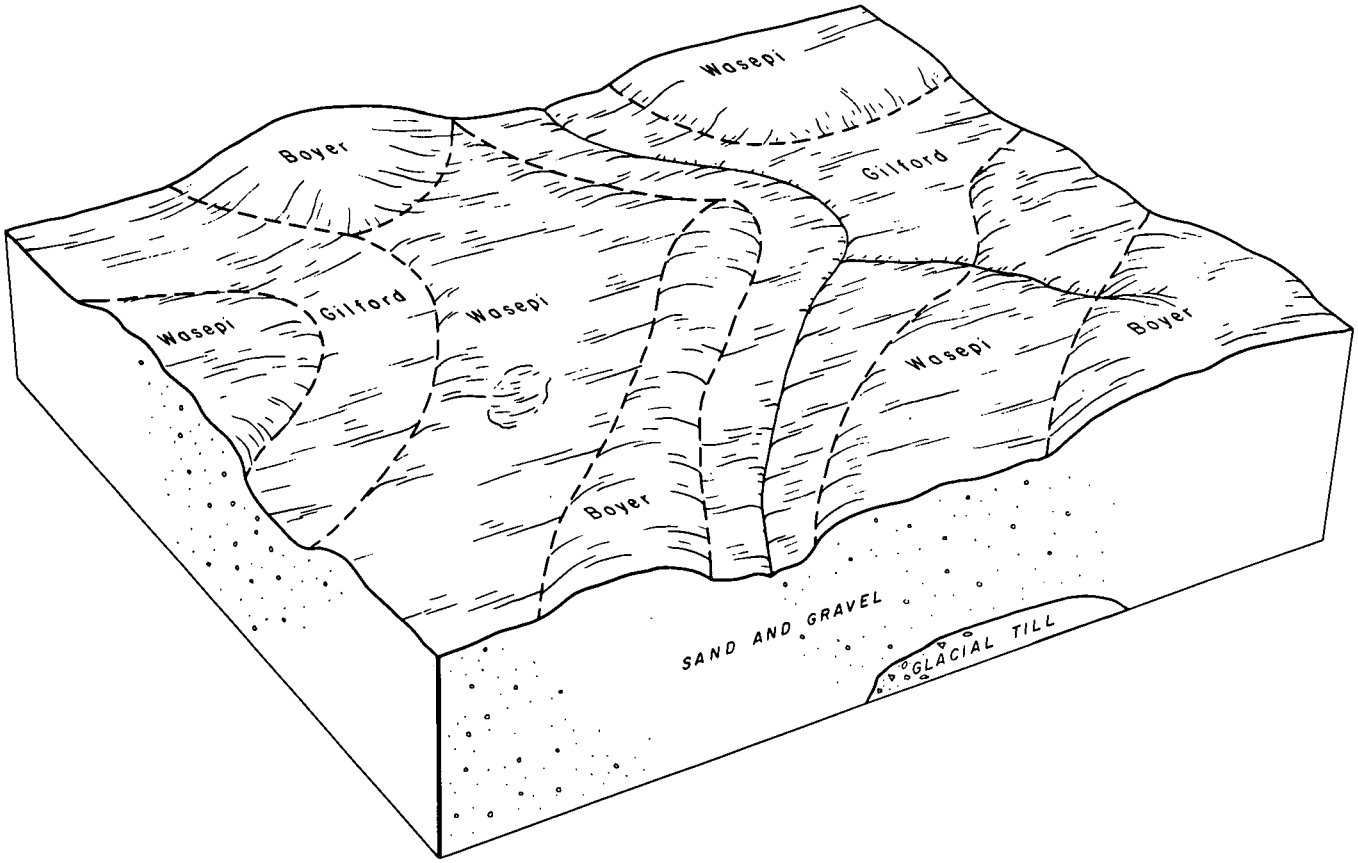

Figure 3.—**Pattern of soils and underlying material in Wasepi-Gilford-Boyer association.**

Blount soils, 15 percent Metamora soils, and 40 percent minor soils (fig. 4).

Pewamo soils are nearly level and are poorly drained to very poorly drained. The surface layer typically is very dark gray loam about 10 inches thick. The subsoil is 8 inches of dark gray silty clay loam; 9 inches of gray, firm silty clay loam mottled with yellowish brown; and of 9 inches gray, firm heavy silty clay loam mottled with strong brown. Yellowish brown, slightly effervescent silty clay loam mottled with gray and brown is at a depth of about 36 inches.

Blount soils are nearly level to gently sloping and are somewhat poorly drained. The surface layer typically is dark grayish brown loam about 9 inches thick. The subsoil is about 4 inches of dark yellowish brown, firm silty clay loam mottled with grayish brown and yellowish brown; about 4 inches of dark yellowish brown, firm clay mottled with grayish brown and yellowish brown; and about 10 inches of dark yellowish brown, firm clay mottled with gray. The underlying material is 13 inches of grayish brown, slightly effervescent silty clay loam mottled with yellowish brown and, at a depth of 40 inches, light yellowish brown silty clay loam mottled with gray and yellowish brown.

Metamora soils are nearly level to gently sloping and are somewhat poorly drained. The surface layer typically is very dark grayish brown sandy loam about 9 inches thick. The subsoil is about 6 inches of pale brown, friable sandy loam mottled with yellowish brown; about 11 inches of grayish brown, friable heavy sandy loam mottled with dark yellowish brown; and about 3 inches of gray, firm silty clay loam mottled with yellowish brown. Dark brown, slightly effervescent silty clay loam mottled with gray and yellowish brown is at a depth of about 29 inches.

Among the minor soils in this association are Corunna, Kibbie, Pella, Selfridge, Sloan, and Wasepi soils.

The minor soils are dominantly at the same position on the landscape as Pewamo, Blount, and Metamora soils. Some are lower. The wet Corunna and Pella soils are in depressional areas. Sloan soils are in nearly level areas along rivers and streams in alluvial positions. Kibbie, Selfridge, and Wasepi soils are in nearly level areas.

Soils in the unshaded part of the general soil map are suited to crops commonly grown in the county. Pewamo, Blount, and Metamora soils have a high available water capacity. Pewamo and Blount soils have

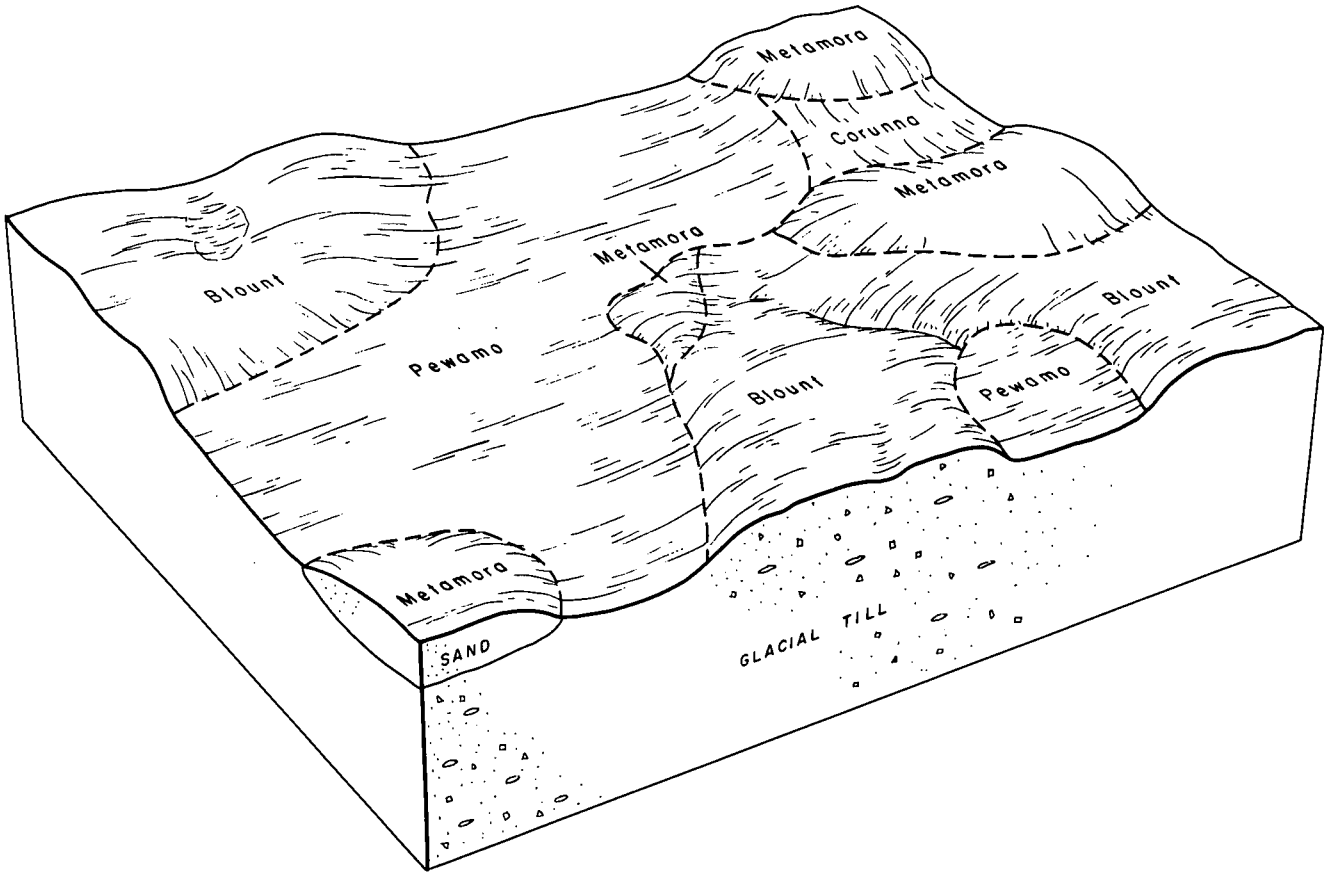

Figure 4.—**Pattern of soils and underlying material in Pewamo-Blount-Metamora association.**

moderately slow permeability. Metamora soils have moderately rapid permeability in the subsoil and moderately slow permeability in the underlying material. Pewamo soils have a moderate organic-matter content, and Blount and Metamora soils have a moderately low organic-matter content. The main concerns of management are controlling wetness and maintaining organic-matter content and tilth. Soil blowing is an additional concern on Metamora soils.

This association is used mainly for corn, small grain, pasture, soybeans, a few truck crops, and hay in farming areas and for homesites, industrial and commercial developments, and roads near villages and cities. A few areas of undrained soils are used as permanent pasture and wildlife habitat. The main farm enterprises are cash crops, dairying, nurseries, and beef cattle.

In the shaded part of the general soil map the main soil limitations are wetness and frost action. Pewamo soils are subject to flooding, and Blount soils have high shrink-swell potential.

3. *Thetford-Granby-Tedrow association*

Nearly level, very poorly drained to somewhat poorly drained soils that have a coarse textured subsoil

The landscape in this soil association is one of nearly level lake plains and moraines that are dissected by streams and creeks (fig. 5).

This soil association occupies about 47,000 acres or 20 percent of the unshaded part of the general soil map and about 24,000 acres or 15 percent of the shaded part. About 25 percent is Thetford soils, 20 percent Granby soils, 15 percent Tedrow soils, and 40 percent minor soils (fig. 6).

Thetford soils are nearly level and are somewhat poorly drained. The surface layer typically is very dark grayish brown loamy sand about 10 inches thick. The subsurface layer is about 3 inches of pale brown fine sand mottled with strong brown. The subsoil is 11 inches of strong brown, very friable fine sand mottled with very pale brown and yellowish brown; 11 inches of pale brown, loose fine sand interbedded with thin layers of loamy fine sand and mottled with light brownish gray and grayish brown; and 8 inches of light gray, loose loamy sand mottled with yellowish brown. Light gray fine sand interbedded with layers of silty clay loam and mottled with light olive brown is at a depth of about 43 inches.

Granby soils are nearly level and are poorly drained to very poorly drained. The surface layer typically is

Figure 5.—Typical landscape of the Thetford-Granby-Tedrow association in Sumpter Township. Darker areas in foreground are Granby soils. Lighter areas are Tedrow and Thetford soils.

very dark brown loamy fine sand 11 inches thick. The upper 8 inches of the subsoil is grayish brown, very friable fine sand mottled with dark gray, pale brown, and yellowish brown. The lower 10 inches is grayish brown, very friable fine sand mottled with dark gray. Gray fine sand is at a depth of about 29 inches.

Tedrow soils are nearly level and are somewhat poorly drained. The surface layer typically is very dark grayish brown loamy fine sand 9 inches thick. The upper 15 inches of the subsoil is yellowish brown, loose fine sand mottled with dark grayish brown. The lower 18 inches is light yellowish brown, loose fine sand. Light yellowish brown fine sand is at a depth of about 42 inches.

Among the minor soils in this association are Oakville, Selfridge, Shoals, Sloan, and Spinks soils and the Tedrow loamy substratum soil.

Some of the minor soils are at a slightly higher position on the landscape than Thetford, Granby, and Tedrow soils. Some are along streams or rivers. The wet Sloan and Shoals soils are on flood plains along streams or rivers. Oakville, Spinks, and Selfridge soils, and the Tedrow loamy substratum soil are on slightly higher rises.

Soils in this association are suited to crops commonly grown in the county. Thetford, Granby, and Tedrow soils have a moderate or moderately low organic-matter content, a low available water capacity, and very slow or ponded runoff. Granby and Tedrow soils have rapid permeability, and Thetford soils have moderately rapid permeability. The main concerns of management are controlling wetness and soil blowing, controlling droughtiness in midsummer, and maintaining fertility and the organic-matter content.

This association is used mainly for corn, small grain, soybeans, truck crops, pasture, or woods. A small part is idle. The association is used for urban development, recreational areas, and roads near villages and cities. A few areas of undrained soils are used as wildlife habitat. The main farm enterprise is cash crops and, to a lesser degree, truck crops, and nurseries.

In the shaded part of the general soil map the main soil limitations are wetness, seepage, frost action, and caving cutbanks.

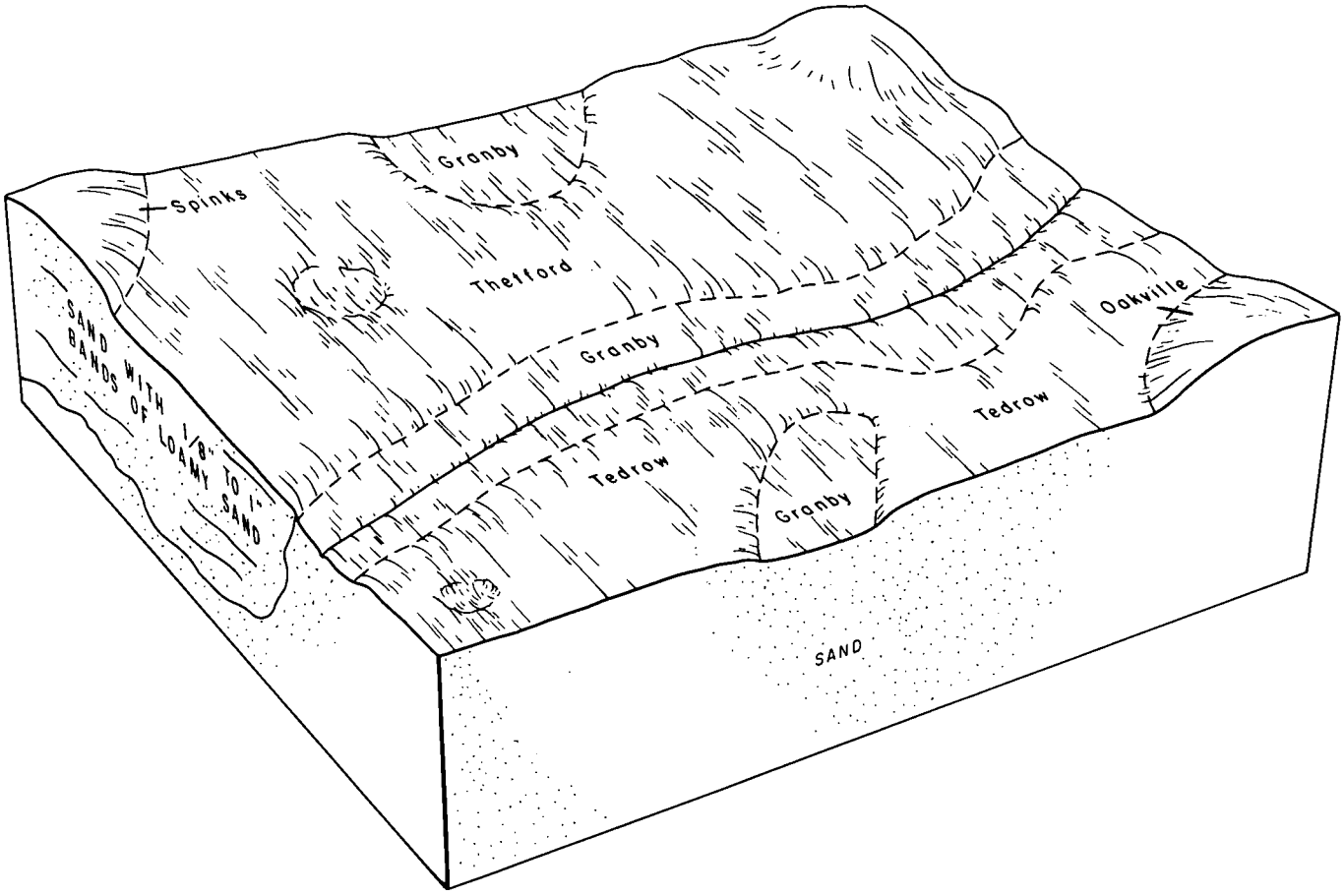

Figure 6.—**Pattern of soils and underlying material in Thetford-Granby-Tedrow association.**

4. *Belleville-Selfridge-Tedrow loamy substratum association*

Nearly level to gently sloping, very poorly drained to somewhat poorly drained soils that have a coarse textured to moderately fine textured subsoil over a coarse textured to moderately fine textured substratum

The landscape in this soil association is one of nearly level to gently sloping lake plains that are dissected by streams and creeks.

This soil association occupies about 15,000 acres or 7 percent of the unshaded part of the general soil map and about 25,000 acres or 16 percent of the shaded part. About 20 percent is Belleville soils, 15 percent Selfridge soils, 15 percent Tedrow loamy substratum soils, and 50 percent minor soils (fig. 7).

Belleville soils are nearly level and are poorly drained to very poorly drained. The surface layer typically is black loamy fine sand about 11 inches thick. The subsoil is 9 inches of grayish brown, loose fine sand mottled with yellowish brown and light gray. The underlying material is 10 inches of light gray fine sand mottled with brown and light olive brown; 4 inches of gray clay loam mottled with dark grayish brown and olive; and at a depth of 34 inches dark grayish brown or gray silty clay loam mottled with dark gray, olive brown, and dark reddish gray.

Selfridge soils are nearly level to gently sloping and are somewhat poorly drained. The surface layer typically is very dark grayish brown loamy sand about 9 inches thick. In sequence downward, the subsoil is about 9 inches of pale brown, loose sand; about 6 inches of yellowish brown, very friable loamy sand; about 5 inches of yellowish brown, friable sandy loam mottled with grayish brown; and about 2 inches of brown, firm clay loam mottled with gray. Grayish brown, strongly effervescent clay loam mottled with yellowish brown and light gray is at a depth of about 31 inches.

Tedrow loamy substratum soils are nearly level and are somewhat poorly drained. The surface layer typically is dark grayish brown loamy fine sand about 9 inches thick. The subsoil is about 14 inches of yellowish brown, very friable loamy sand; about 15 inches of brown, loose sand; and about 7 inches of brown, loose sand. The underlying layer is about 2 inches of yellowish brown very fine sand mottled with grayish brown. Yellowish brown silty clay loam mottled with gray is at a depth of about 47 inches.

Among the minor soils in this association are

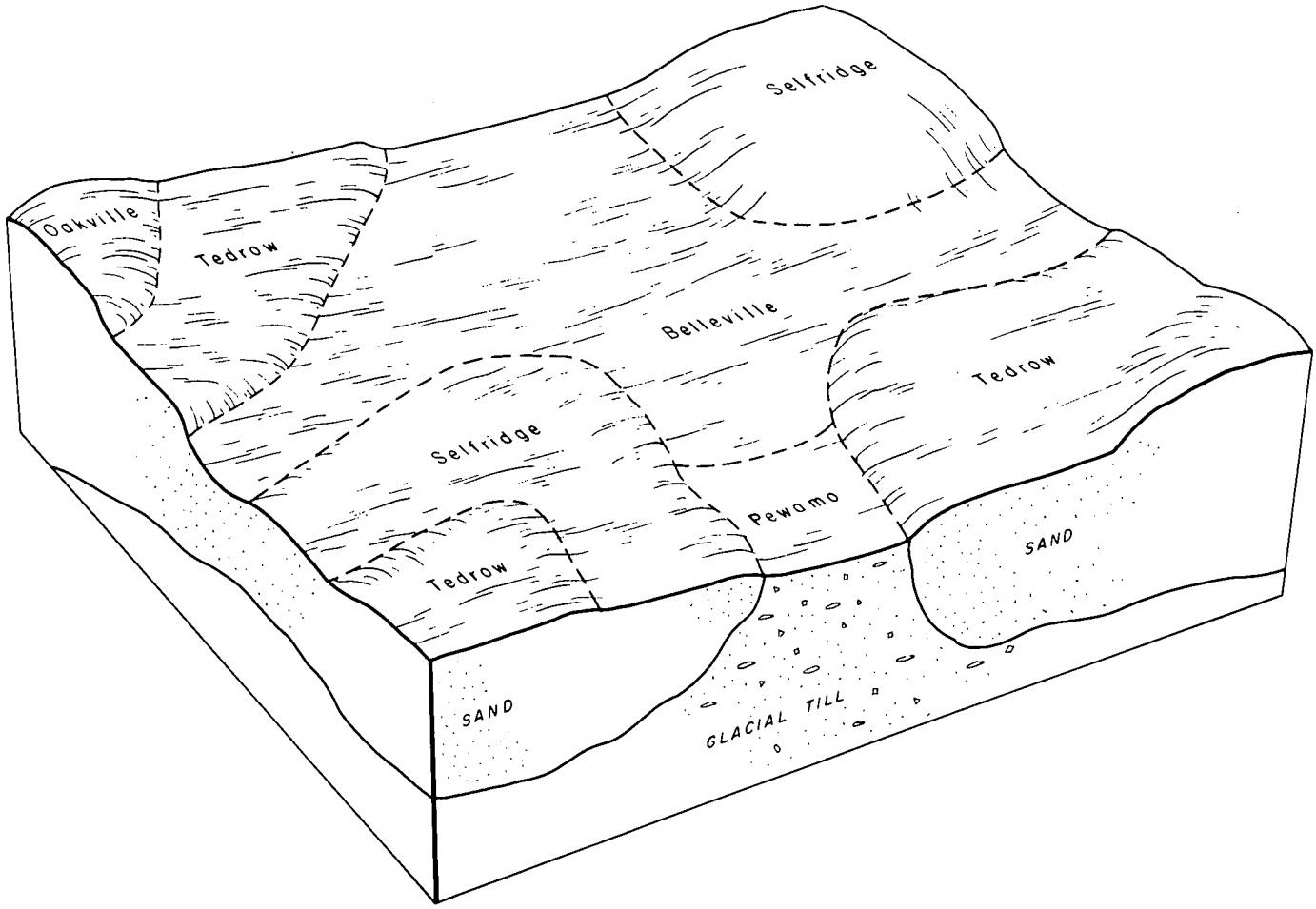

Figure 7.—**Pattern of soils and underlying material in Belleville-Selfridge-Tedrow loamy substratum association.**

Granby, Oakville, Pewamo, Shoals, Tedrow, and Thetford soils.

The minor soils are widely interspersed with Belleville, Selfridge, and the Tedrow loamy substratum soils. Oakville soils are on slightly higher rises. Shoals soils are in nearly level areas next to rivers and streams. Tedrow, Granby, and Thetford soils have about the same slope as the major soils, but they are in more sandy areas. Pewamo soils also are nearly level to gently sloping.

Soils in the unshaded part of the general soil map are suited to crops commonly grown in the county. Belleville and Selfridge soils have a moderately low or moderate organic-matter content and a moderate available water capacity. The Tedrow loamy substratum soils have a low organic-matter content and a moderate available water capacity. All the major soils in this association have rapid permeability in the solum and moderately slow permeability in the underlying material. Runoff is very slow or ponded. The main concerns of management are controlling wetness and soil blowing, controlling droughtiness in midsummer, and maintaining fertility and the organic-matter content.

This association is used mainly for corn, small grain, soybeans, truck crops, and sod production in farming areas and for urban development and roads near cities. Part of it is idle. A few areas of undrained soils are wooded. The main farm enterprises are cash crops, truck crops, and sod production.

In the shaded part of the general soil map the main soil limitations are wetness, frost action, and caving of cutbanks.

5. *Pewamo-Selfridge-Corunna association*

Nearly level to gently sloping, very poorly drained to somewhat poorly drained soils that have a moderately fine textured to coarse textured subsoil

The landscape in this soil association is one of nearly level to gently sloping lake plains that are dissected by streams and creeks.

This soil association occupies about 44,400 acres or 19 percent of the unshaded part of the general soil map and about 26,000 acres or 17 percent of the shaded part. About 25 percent is Pewamo soils, 20 percent Selfridge soils, 15 percent Corunna soils, and 40 percent minor soils (fig. 8).

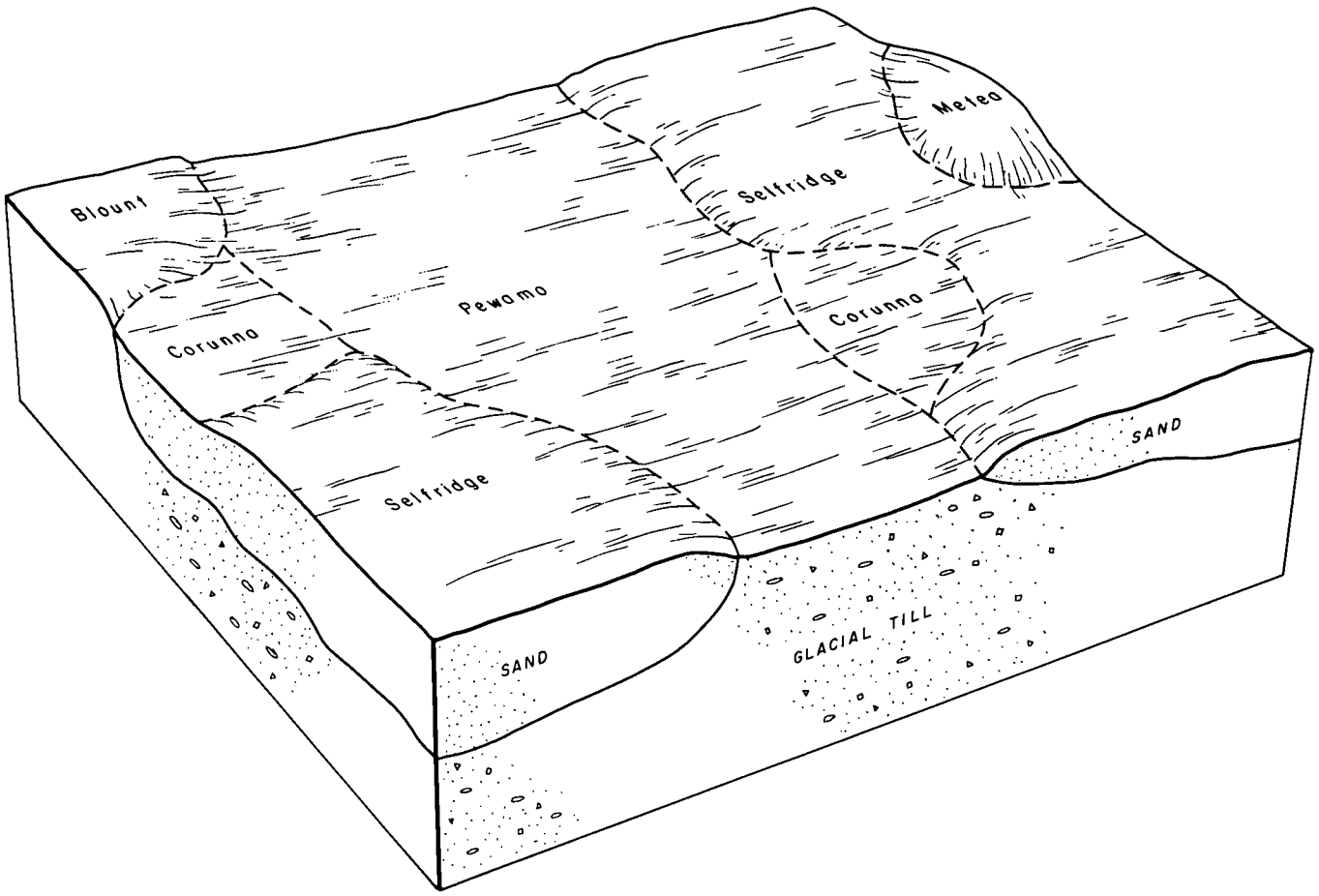

Figure 8.—**Pattern of soils and underlying material in Pewamo-Selfridge-Corunna association.**

Pewamo soils are nearly level to gently sloping and are poorly drained to very poorly drained. The surface layer typically is very dark gray loam about 10 inches thick. The subsoil is 8 inches of dark gray silty clay loam; 9 inches of gray, firm silty clay loam mottled with yellowish brown; and 9 inches of gray, firm heavy silty clay loam mottled with strong brown. Yellowish brown, slightly effervescent silty clay loam mottled with gray and brown is at a depth of about 36 inches.

Selfridge soils are nearly level to gently sloping and are somewhat poorly drained. The surface layer typically is very dark grayish brown loamy sand about 9 inches thick. In sequence downward, the subsoil is about 9 inches of pale brown, loose sand; 6 inches of yellowish brown, very friable loamy sand; 5 inches of yellowish brown, friable sandy loam mottled with grayish brown; and 2 inches of brown, firm clay loam mottled with gray. Grayish brown, strongly effervescent clay loam mottled with yellowish brown and light gray is at a depth of about 31 inches.

Corunna soils are nearly level and poorly drained. The surface layer typically is very dark gray fine sandy loam about 11 inches thick. The subsoil is about 8 inches of gray, friable fine sandy loam mottled with dark gray; 6 inches of grayish brown, friable sandy loam mottled with yellowish brown and gray; and 9 inches of grayish brown, very friable loamy sand mottled with yellowish brown. Grayish brown silty clay loam mottled with yellowish brown and gray is at a depth of 34 inches.

Among the minor soils in this association are Belleville, Blount, Metea, Oakville, Shoals, and Sloan soils and the Tedrow loamy substratum soil.

The minor soils are dominantly at the same position on the landscape as Pewamo, Selfridge, and Corunna soils. Some are higher. Blount, Metea, and Oakville soils and the Tedrow loamy substratum soil are in nearly level and gently sloping convex areas. Belleville soils are in nearly level or concave areas, and Shoals and Sloan soils are in nearly level alluvial areas along rivers and streams.

Soils in the unshaded part of the general soil map are suited to crops commonly grown in the county. Pewamo soils have a moderate organic-matter content, moderately slow permeability, and a high available water capacity. Selfridge soils have a moderately low organic-matter content, rapid permeability in the subsoil but moderately slow permeability in the underlying material, and a moderate available water capacity.

Corunna soils have a moderate organic-matter content, moderate permeability in the subsoil but moderately slow permeatbility in the underlying material, and a high available water capacity. The main concerns of management are removing excess water and maintaining tilth and fertility.

This association is used mainly for corn, small grain, soybeans, and hay in farming areas and for homesites, industrial and commercial developments, recreational areas, airports, and roads near villages and cities. A few areas of undrained soils are used as permanent pasture and wildlife habitat. The main farm enterprises are cash crops, beef cattle, and truckcropping.

In the shaded part of the general soil map the main soil limitations are wetness and frost action. Pewamo soils are subject to flooding, and Selfridge soils are subject to caving of cutbanks.

6. *Hoytville-Nappanee association*

Nearly level and gently sloping, very poorly drained and somewhat poorly drained soils that have a fine textured subsoil

The landscape in this soil association is one of nearly level and gently sloping lake plains and moraines that are dissected by streams and creeks.

This soil assocation occupies about 39,000 acres or 17 percent of the unshaded part of the general soil map and about 25,000 acres or 16 percent of the shaded part. About 45 percent is Hoytville soils, 40 percent Nappanee soils, and 15 percent minor soils (fig. 9).

Hoytville soils are nearly level and are very poorly drained. The surface layer typically is very dark gray silty clay loam about 9 inches thick. The upper 21 inches of the subsoil is gray, firm clay mottled with yellowish brown. The lower 8 inches is grayish brown, firm silty clay mottled with yellowish brown and light gray. The underlying material is 12 inches of gray clay mottled with yellowish brown and at a depth of 50 inches light gray mottled with light yellowish brown, brown, and dark yellowish brown.

Nappanee soils are nearly level or gently sloping and are somewhat poorly drained. The surface layer typically is dark grayish brown silt loam 7 inches thick. The subsoil is about 4 inches of yellowish brown, firm clay mottled with grayish brown; about 13 inches of grayish brown, firm clay mottled with yellowish brown; and about 5 inches of grayish brown, firm clay mottled with yellowish brown, gray, and brown. Gray or light gray clay or silty clay mottled with yellowish brown, brown, or light olive brown is at a depth of about 29 inches.

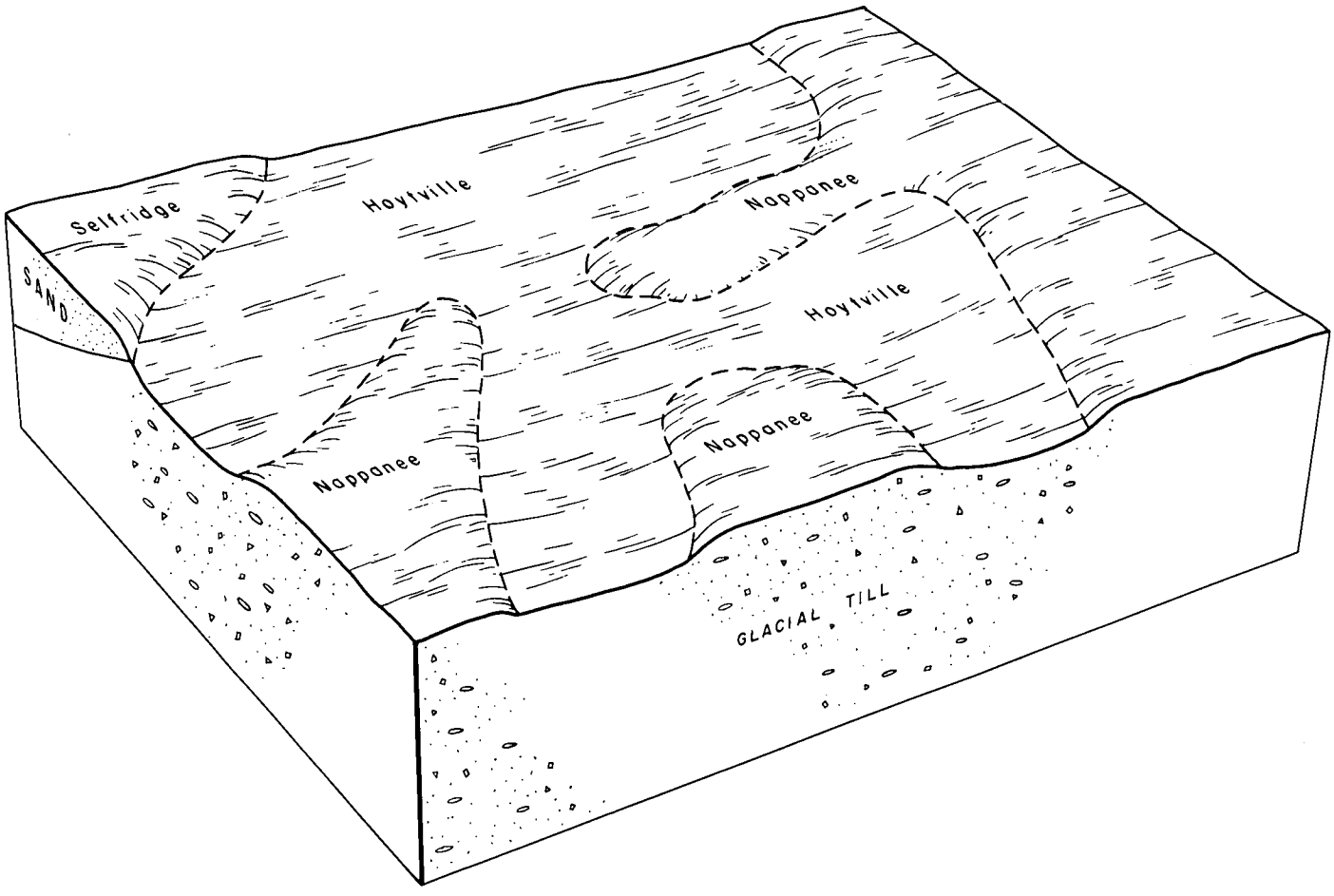

Figure 9.—**Pattern of soils and underlying material in Hoytville-Nappanee association.**

Among the minor soils in this association are Blount, Pewamo, and Selfridge soils.

The minor soils are interspersed with Hoytville and Nappanee soils. Blount and Pewamo soils have the same slope as the major soils, but they are generally at the edges of this association. Selfridge soils are on slightly higher sandy rises.

Soils in the unshaded part of the general soil map are suited to crops commonly grown in the county. Hoytville and Nappanee soils have a moderate available water capacity, a moderate or moderately low organic-matter content, very slow or slow permeability, and slow to ponded runoff. The main concerns of management are controlling wetness and maintaining tilth.

This association is used mainly for corn and soybeans in farming areas and for urban development and roads near cities. Some areas are idle. A few areas of undrained soils are in woodland or in recreational uses. The main farm enterprise is cash crops.

In the shaded part of the general soil map the main soil limitations are wetness, high shrink-swell potential, and frost action.

7. *Pewamo-Blount association*

Nearly level and gently sloping, very poorly drained to somewhat poorly drained soils that have a moderately fine textured and fine textured subsoil

The landscape in this soil association is one of nearly level and gently sloping lake plains and moraines that are dissected by streams and creeks.

This soil association occupies about 13,000 acres or 6 percent of the unshaded part of the general soil map and about 3,000 acres or 2 percent of the shaded part. About 45 percent is Pewamo soils, 35 percent Blount soils, and 20 percent minor soils (fig. 10).

Pewamo soils are nearly level and are poorly drained to very poorly drained. The surface layer typically is very dark gray loam about 10 inches thick. The subsoil is 8 inches of dark gray silty clay loam; 9 inches of gray, firm silty clay loam mottled with yellowish brown; and 9 inches of gray, firm heavy silty clay loam mottled with strong brown. Yellowish brown, slightly effervescent silty clay loam mottled with gray and brown is at a depth of about 36 inches.

Blount soils are nearly level to gently sloping and are somewhat poorly drained. The surface layer typically is dark grayish brown loam about 9 inches thick. The subsoil is 4 inches of dark yellowish brown, firm silty clay loam mottled with grayish brown and yellowish brown; 4 inches of dark yellowish brown firm clay mottled with grayish brown and yellowish brown; and 10 inches of dark yellowish brown firm clay mottled with gray. The underlying material is 13 inches of grayish brown, slightly effervescent silty clay loam mottled with yellowish brown and at a depth of 40 inches light yellowish brown silty clay loam mottled with gray and yellowish brown.

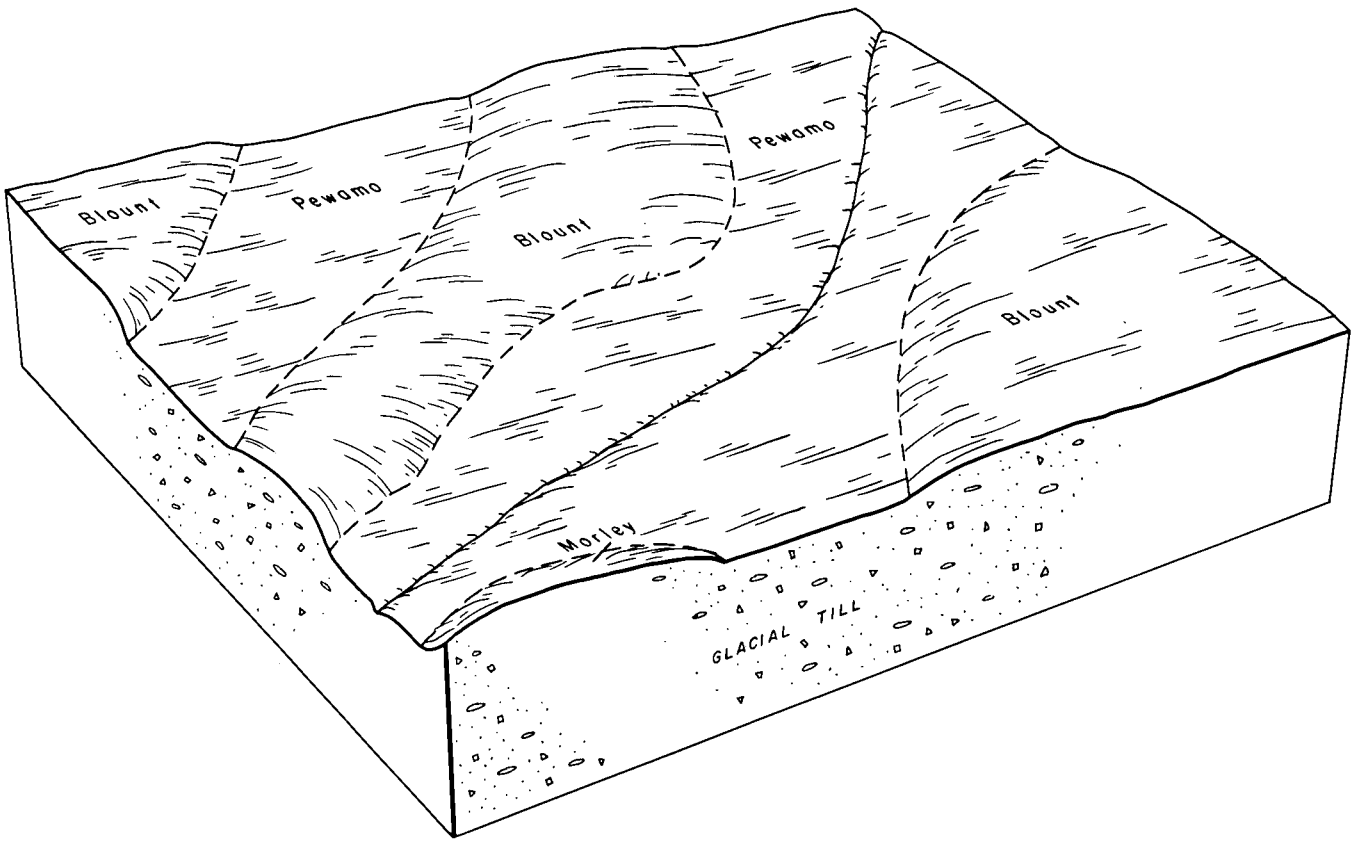

Figure 10.—Pattern of soils and underlying material in Pewamo-Blount association.

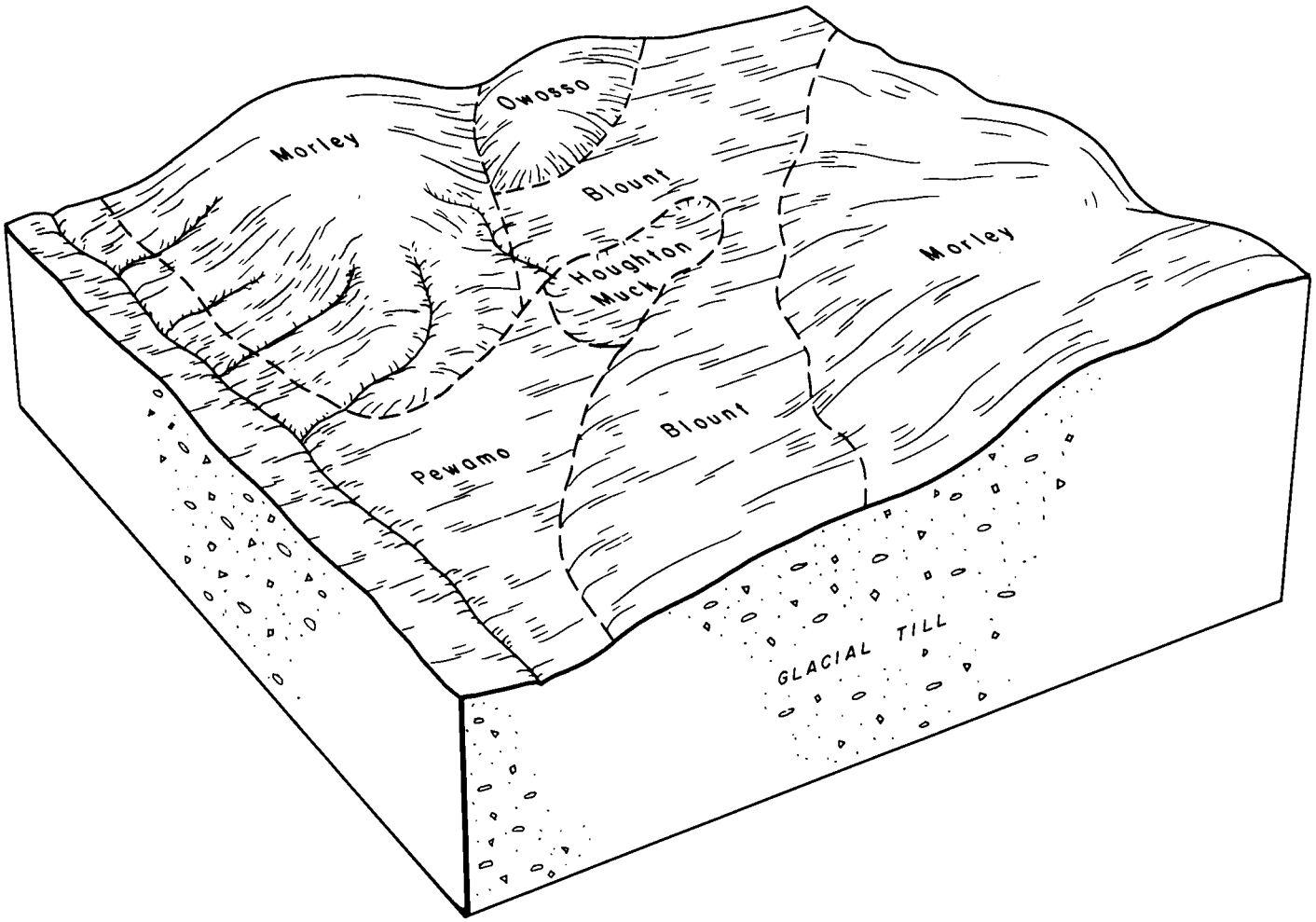

Figure 11.—**Pattern of soils and underlying material in Morley-Blount association.**

Among the minor soils in this association are Metamora, Morley, Nappanee, and Selfridge soils.

The minor soils are generally at slightly higher positions on the landscape than Pewamo soils. Morley soils are on the highest gently sloping rises. Nappanee soils are interspersed with Blount soils, generally in small areas, and Metamora and Selfridge are on sandy rises.

Soils in the unshaded part of the general soil map are suited to crops commonly grown in the county. Pewamo and Blount soils have a high available water capacity, a moderate or moderately low organic-matter content, moderately slow permeability, and slow to ponded runoff. The main concerns of management are controlling wetness and maintaining tilth.

This association is used mainly for corn, soybeans, and small grain in farming areas and for urban development and roads near cities. Some areas are idle. A few areas of undrained soils are wooded. The main farm enterprise is cash crops.

In the shaded part of the general soil map the main soil limitations are wetness and frost action. Pewamo soils are subject to flooding, and Blount soils have high shrink-swell potential.

8. Morley-Blount association

Nearly level to strongly sloping, somewhat poorly drained to well drained soils that have a moderately fine textured and fine textured subsoil

The landscape in this soil association is one of gently sloping to strongly sloping moraines and till plains that are dissected by streams and rivers.

This soil association is all within the unshaded part of the general soil map. It occupies about 12,000 acres or 5 percent of the area. About 40 percent is Morley soils, 30 percent Blount soils, and 30 percent minor soils (fig. 11).

Morley soils are gently sloping to strongly sloping and are well drained to moderately well drained. The surface layer typically is very dark grayish brown loam about 8 inches thick. The upper 5 inches of the subsoil is yellowish brown, firm clay loam mottled with brown, and the lower 13 inches is dark yellowish brown, firm clay. Brown, slightly effervescent clay loam mottled with yellowish brown is at a depth of 26 inches.

Blount soils are nearly level to gently sloping and are somewhat poorly drained. The surface layer typi-

cally is dark grayish brown loam about 9 inches thick. The subsoil is 4 inches of dark yellowish brown, firm silty clay loam mottled with grayish brown and yellowish brown; 4 inches of dark yellowish brown, firm clay mottled with grayish brown and yellowish brown; and 10 inches of dark yellowish brown, firm clay mottled with gray. The underlying material is 13 inches of grayish brown, slightly effervescent silty clay loam mottled with yellowish brown and at a depth of 40 inches light yellowish brown silty clay loam mottled with gray and yellowish brown.

Among the minor soils in this association are Nappanee, Owosso, Pewamo, St. Clair, and Wasepi soils and small areas of Houghton and Edwards muck.

The minor soils are dominantly at the same position on the landscape as Morley and Blount soils. Some are lower. Pewamo and Wasepi soils are in nearly level areas and along streams and rivers. Houghton and Edwards muck are in small depressional areas. Nappanee, St. Clair, and Owosso soils have the same slope as the major soils.

Soils in this association are suited to crops commonly grown in the county. Morley and Blount soils have a high available water capacity, a low or moderately low organic-matter content, moderately slow permeability, and slow to rapid runoff. The main concerns of management are controlling water erosion, removing excess water, and maintaining organic-matter content and tilth.

This association is used mainly for corn, soybeans, small grain, and hay and pasture in farming areas. Some areas are in woodland or other nonfarm uses. Some are left idle.

Descriptions of the Soils

In this section, the soil series and mapping units in the Wayne County Area are described. Each soil series is described in detail, and then, each mapping unit in that series is described briefly. Unless otherwise mentioned, 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. 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 differs from the one described for the series, the differences are stated in the description of the mapping unit or 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. Cut and fill land, for example, does not belong to a soil series; nevertheless, it is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Following the description of each mapping unit are the capability unit, the Michigan soil management group, shown in parentheses, and the woody plant group to which the mapping unit has been assigned. For soil complexes, the Michigan soil management groups are listed in parentheses in the same order as the soils for which the complex is named. These groups are used for making recommendations about artificial drainage, applications of lime and fertilizer, and other practices. For an explanation of this classification, refer to "Fertilizer Recommendations for Vegetables and Field Crops in Michigan" (*3*). The page for the description of each capability unit or Michigan soil management group can be found by referring to 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 at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*5*).

The names, descriptions, and delineations of soils in this survey do not always agree with those of soils on maps adjoining counties published at an earlier date. Such differences are brought about by more accurate knowledge of soils or modifications and refinements in soil series concepts, and by the fact that the correlation of a recognized soil is based upon the extent of that soil and its dissimilarity to adjacent soils within the survey area. Frequently, it is more feasible to include soils of limited extent with similar, more extensive soils, if management and response are much the same, than to map them as individual soils. The soil descriptions reflect these combinations. Other differences are brought about by the predominance of different soils in units made up of two or three series. Still another difference is caused by the range in slope allowed within the mapping unit for each survey.

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

Soil	Acres	Percent
Belleville loamy fine sand	6,725	2.9
Blount loam, 0 to 4 percent slopes	20,960	9.0
Blount-Pewamo loams, 0 to 2 percent slopes	2,235	1.0
Boyer loamy sand, 0 to 6 percent slopes	5,110	2.2
Boyer loamy sand, 6 to 12 percent slopes	1,680	.7
Cohoctah fine sandy loam, frequently flooded	850	.4
Corunna fine sandy loam	4,480	1.9
Cut and fill land	10,820	4.6
Edwards muck	155	.1
Gilford sandy loam	5,995	2.6
Granby loamy fine sand	11,665	5.0
Houghton muck	235	.1
Hoytville silty clay loam	7,660	3.3
Kibbie fine sandy loam, 0 to 3 percent slopes	6,045	2.6
Made land	2,205	.9
Marsh	1,335	.6
Metamora sandy loam, 0 to 3 percent slopes	8,225	3.5
Metamora-Pewamo complex, 0 to 3 percent slopes	1,485	.6
Metea loamy sand, 2 to 6 percent slopes	1,170	.5
Morley loam, 2 to 6 percent slopes	3,425	1.5
Morley loam, 6 to 12 percent slopes	1,980	.9

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

Soil	Acres	Percent
Morley loam, 12 to 18 percent slopes	585	.3
Nappanee silt loam, 0 to 4 percent slopes	7,895	3.4
Oakville fine sand, 0 to 6 percent slopes	6,510	2.8
Owosso-Morley complex, 2 to 6 percent slopes	615	.3
Owosso-Morley complex, 6 to 12 percent slopes	265	.1
Pella silt loam	4,110	1.8
Pewamo loam	19,340	8.3
Selfridge loamy sand, 0 to 3 percent slopes	11,185	4.8
Selfridge-Pewamo complex, 0 to 2 percent slopes	5,570	2.4
Selfridge-Pewamo-Metea complex, 0 to 4 percent slopes	2,265	1.0
Shoals silt loam	2,060	.9
Sloan silt loam, wet	3,945	1.7
Spinks loamy sand, 0 to 6 percent slopes	3,690	1.6
Spinks loamy sand, 6 to 12 percent slopes	640	.3
St. Clair clay loam, 2 to 6 percent slopes	360	.1
St. Clair clay loam, 6 to 12 percent slopes	420	.2
Tedrow loamy fine sand, 0 to 2 percent slopes	17,480	7.5
Tedrow loamy fine sand, loamy substratum, 0 to 2 percent slopes	7,875	3.4
Thetford loamy sand, 0 to 2 percent slopes	17,020	7.3
Wasepi loamy sand, 0 to 2 percent slopes	9,105	3.9
Wasepi loamy sand, loamy substratum, 0 to 2 percent slopes	2,155	.9
Miscellaneous	1,225	.5
Water	3,705	1.6
Total	232,460	100.0

Belleville Series

The Belleville series consists of poorly drained and very poorly drained, nearly level soils on lake plains and till plains. These soils formed in 20 to 40 inches of sandy glaciofluvium underlain by loamy lacustrine or till material.

In a representative profile, the surface layer is black loamy fine sand 11 inches thick. The subsoil is 9 inches of grayish brown, loose fine sand mottled with yellowish brown and light gray. The underlying material is 10 inches of light gray fine sand mottled with brown and light olive brown; 4 inches of gray clay loam mottled with dark grayish brown and olive; and at a depth of 34 inches dark grayish brown or gray silty clay loam mottled with dark gray, olive brown, and dark reddish gray.

Permeability is rapid in the subsoil and upper part of the underlying material and moderately slow in the lower part. The available water capacity is moderate. Runoff is very slow or ponded.

Belleville soils are moderately well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated, and in some areas specialty crops are grown. The rest is wooded or idle.

Representative profile of Belleville loamy fine sand, in an idle field, 528 feet west and 264 feet south of the northeast corner of SE1/4, sec. 34, T. 4 S., R. 8 E.

Ap—0 to 11 inches, black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; moderate, medium, granular structure; friable; common fine roots; mildly alkaline; abrupt, smooth boundary.

B2g—11 to 20 inches, grayish brown (2.5Y 5/2) fine sand; few, fine, distinct, yellowish brown (10YR 5/6) mottles and few, fine, faint, light gray (10YR 6/1) mottles; single grained; loose; black (10YR 2/1) root channels; few fine roots; mildly alkaline; clear, wavy boundary.

C1g—20 to 30 inches, light gray (10YR 6/1) fine sand; common, fine, distinct, brown (7.5YR 4/4) mottles and common, medium, distinct, light olive brown (2.5Y 5/4) mottles; single grained; loose; slight effervescence; mildly alkaline; abrupt, smooth boundary.

IIC2g—30 to 34 inches, gray (5Y 5/1), clay loam; common, medium, distinct, dark grayish brown (2.5Y 4/2) mottles and few, fine, distinct, olive (5Y 5/6) mottles; moderate, coarse, subangular blocky structure; firm; 1 percent pebbles; strong effervescence; moderately alkaline; clear, wavy boundary.

IIC3g—34 to 51 inches, dark grayish brown (2.5Y 4/2) silty clay loam; common, medium, distinct, dark gray (5Y 4/1) mottles; massive; firm; 3 percent pebbles; strong effervescence; moderately alkaline; clear, wavy boundary.

IIC4g—51 to 55 inches, gray (10YR 5/1) silty clay loam; common, medium, distinct, olive brown (2.5Y 4/4) mottles; massive; firm; 5 percent pebbles; strong effervescence; moderately alkaline; clear, wavy boundary.

IIC5g—55 to 60 inches, gray (10YR 5/1) silty clay loam; few, fine, distinct, dark reddish gray (5YR 4/2) mottles; massive; firm; 2 percent pebbles; strong effervescence; moderately alkaline.

Thickness of the solum is 20 to 30 inches and corresponds to the depth of effervescent material. Depth to the IICg horizon is 25 to 40 inches. Reaction ranges from slightly acid to mildly alkaline in the upper part and neutral to moderately alkaline in the lower part. The content of coarse fragments in the sandy horizons is 0 to 3 percent pebbles and in the loamy horizons 5 percent or less pebbles and cobblestones.

The Ap horizon has hue of 10YR or 5Y, value of 2 or 3, and chroma of 1 or 2.

The B2g horizon is dark gray (10YR 4/1), gray (10YR 5/1), or grayish brown (10YR 5/2 or 2.5Y 5/2) loamy fine sand, loamy sand, fine sand, or sand.

The C1g horizon has hue of 10YR, 2.5Y, and 5Y, value of 4 to 6, and chroma of 1 to 3. It is loamy fine sand, loamy sand, fine sand, or sand. It is moderately alkaline or mildly alkaline and has slight or strong effervescence. The IICg horizon has hue of 10YR, 2.5Y, and 5Y, value of 4 or 5, and chroma of 1 to 3. It is silty clay loam, clay loam, or loam.

Belleville soils in most landscapes are near Corunna, Granby, and Selfridge soils. They lack the loamy texture that is throughout Corunna soils and the sandy texture in the IIC horizon that is throughout the Cg horizon of Granby soils. Unlike Selfridge soils, Belleville soils lack the brown or yellowish brown color in the upper part of the B horizon.

Ba—Belleville loamy fine sand. This soil is in low, irregularly shaped, flat areas that range from about 5 to 160 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Selfridge and Tedrow soils on slightly higher ridges and knolls and small areas of soils that have a clay or silty clay layer in the underlying material. Areas of Belleville soils that have been excavated are identified by spot symbols on the soil map. Also identified are small areas of soils that have a mucky surface layer and a thin subsurface layer of marl, and areas of soils that are ponded and marshy.

Some low depressional areas of this soil are subject to flooding for brief periods by runoff from adjacent areas. The main concerns of management are removing excess water and controlling soil blowing. In drained areas, conserving moisture in midsummer is also a concern.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops and sod pro-

duction if drained and irrigated. Most areas are cropped, and in some areas specialty crops are grown. The rest is idle or wooded. Capability unit IIIw-4 (4/2c); woody plant group 5.

Blount Series

The Blount series consists of somewhat poorly drained, nearly level to gently sloping soils on till plains and moraines. These soils formed in loamy glacial till.

In a representative profile, the surface layer is dark grayish brown loam 9 inches thick. The subsoil is 4 inches of dark yellowish brown, firm silty clay loam mottled with grayish brown and yellowish brown; 4 inches of dark yellowish brown, firm clay mottled with grayish brown and yellowish brown; and 10 inches of dark yellowish brown, firm clay mottled with gray. The upper 13 inches of the underlying material is grayish brown silty clay loam mottled with yellowish brown. The lower part, at a depth of 40 inches, is light yellowish brown silty clay loam mottled with gray and yellowish brown.

Permeability is moderately slow. The available water capacity is high. Runoff is slow.

Blount soils are well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated. The rest is wooded or pastured, in nonfarm uses, or idle.

Representative profile of Blount loam, 0 to 4 percent slopes, in a hayfield, 204 feet east and 621 feet south of the northwest corner of sec. 4, T. 2 S., R. 8 E.

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) loam; moderate, medium, granular structure; friable; many fine roots; 4 percent pebbles and cobblestones; slightly acid; abrupt, smooth boundary.

B21t—9 to 13 inches, dark yellowish brown (10YR 4/4) ped interiors, grayish brown (10YR 5/2) ped exteriors, silty clay loam; common, medium, distinct, grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) ped interior mottles and yellowish brown (10YR 5/6) ped exterior mottles; moderate, medium, subangular blocky structure; firm; discontinuous, thin, grayish brown (10YR 5/2) clay films on surfaces of peds; common fine roots; 4 percent pebbles and cobblestones; medium acid; clear, wavy boundary.

B22t—13 to 17 inches, dark yellowish brown (10YR 4/4) ped interiors, grayish brown (10YR 5/2) ped exteriors, clay; common, medium, distinct, grayish brown (10YR 5/2) ped interior mottles and yellowish brown 10YR 5/6) ped exterior mottles; moderate, fine, angular blocky structure; firm; continuous, moderately thick, grayish brown (10YR 5/2) clay films on surfaces of peds; common fine roots; 4 percent pebbles and cobblestones; neutral; clear, wavy boundary.

B23t—17 to 27 inches, dark yellowish brown (10YR 4/4) ped interiors, gray (10YR 5/1) ped exteriors, clay; common, medium, distinct, gray (10YR 5/1) ped interior mottles; moderate, medium, angular blocky structure; firm; discontinuous, moderately thick, gray (10YR 5/1) clay films on surfaces of peds; few fine roots; 4 percent pebbles and cobblestones; slight effervescence; mildly alkaline; gradual, wavy boundary.

C1g—27 to 40 inches, grayish brown (10YR 5/2) silty clay loam; common, medium, faint, gray (10YR 5/1) mottles and common, medium, distinct, yellowish brown (10YR 5/5) mottles; massive, firm; light gray (10YR 7/1) lime streaks; 4 percent pebbles and cobblestones; slight effervescence; mildly alkaline; gradual, wavy boundary.

C2—40 to 60 inches, light yellowish brown (10YR 6/4) silty clay loam; common, medium, distinct, gray (10YR 5/1) mottles and yellowish brown (10YR 5/6) mottles; massive; firm; light gray (10YR 7/1) lime streaks; 4 percent pebbles and cobblestones; slight effervescence; mildly alkaline.

Thickness of the solum is 20 to 35 inches. Reaction is medium acid to mildly alkaline in the upper part and neutral to mildly alkaline in the lower part. The content of pebbles and cobblestones throughout the solum ranges from 0 to 5 percent.

The Ap horizon is dark grayish brown (10YR 4/2) or dark gray (10YR 4/1).

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. It is clay, clay loam, silty clay, or silty clay loam.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 6. It is clay loam or silty clay loam. It is mildly alkaline and is slightly or strongly effervescent.

Blount soils in most landscapes are near Hoytville, Kibbie, Metamora, Morley, and Pewamo soils. Unlike Hoytville and Pewamo soils, they lack the overall gray color in the B horizon. They are finer textured in the B horizon than Kibbie soils. They have a finer textured B horizon than Metamora soils and have more distinct gray mottles in the B horizon than Morley soils.

BbB—Blount loam, 0 to 4 percent slopes. This soil is in irregularly shaped, convex areas that range from about 3 to 200 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Morley soils on the tops of knolls or rises. Also included are small areas of Metamora and Selfridge soils on the tops or foot slopes of rises, Pewamo soils in small depressions or natural waterways, and small areas where the surface layer is sandy loam or clay loam. Small wetter areas, excavated areas, and short scattered areas of Blount loam where slope is more than 4 percent are identified by spot symbols on the soil map.

The main concerns of management are removing excess water, controlling soil erosion, and maintaining organic-matter content and tilth.

This soil is suited to crops commonly grown in the county. Most areas are cropped or are in pasture. Some areas are idle, wooded, or in nonfarm uses. Capability unit IIw-2 (1.5b); woody plant group 2.

BcA—Blount-Pewamo loams, 0 to 2 percent slopes. This mapping unit is on broad, nearly level lake plains and till plains.

It is about equal proportions of Blount and Pewamo soils, each making up from 40 to 60 percent. Minor soils make up about 20 percent. The Blount soil is on slightly raised mounds or knolls. The Pewamo soil is in depressions ½ foot to 2 feet lower than the adjacent areas of Blount loam. Areas range from about 30 to 300 acres in size.

Included with this unit in mapping are small areas of Metamora soils on slightly higher rises, small areas of Corunna soils in depressions, and areas of soils along major drainageways that have slopes of 3 to 5 percent.

Some low depressional areas are subject to flooding. The main concerns of management are removing excess water and maintaining organic-matter content and tilth.

This mapping unit is suited to crops commonly grown in the county. Most areas are cropped. Some are idle or wooded, and a few are under urban develop-

ment. Capability unit IIw-2 (1.5b, 1.5c) ; woody plant group 2.

Boyer Series

The Boyer series consists of well drained, nearly level to sloping soils on deltas and outwash plains. These soils formed in sandy and gravelly glaciofluvial deposits.

In a representative profile, the surface layer is dark grayish brown loamy sand 9 inches thick. The subsoil is 9 inches of dark brown, very friable heavy loamy sand; 8 inches of reddish brown, friable sandy clay loam; and 3 inches of yellowish brown, loose gravelly loamy sand mottled with brown. The underlying material, at a depth of 20 inches, is grayish brown gravelly sand.

Permeability is moderately rapid. The available water capacity is low. Runoff is very slow in nearly level areas to medium in sloping areas.

Boyer soils are moderately well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated. The rest is wooded or idle.

Representative profile of Boyer loamy sand, 0 to 6 percent slopes, in a cultivated field, 117 feet north and 1,314 feet east of the southwest corner of sec. 20, T. 3 S., R. 8 E.

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) loamy sand; weak, medium granular structure; very friable; common fine roots; 10 percent pebbles; neutral; abrupt, smooth boundary.

B21t—9 to 18 inches, dark brown (7.5YR 4/4) heavy loamy sand; weak, medium, subangular blocky structure; very friable; few thin clay bridging between sand grains; few fine roots; 15 percent pebbles; neutral; abrupt, wavy boundary.

B22t—18 to 26 inches, reddish brown (5YR 4/4) sandy clay loam; common, medium, faint, dark reddish brown (5YR 3/4) mottles; moderate, medium, subangular blocky structure; friable; continuous, thin clay bridging between sand grains; few fine roots; 10 percent pebbles; neutral; abrupt, wavy boundary.

B3—26 to 29 inches, yellowish brown (10YR 5/6) gravelly loamy sand; common, medium, distinct, brown (10YR 5/3) mottles; single grained; loose; 20 percent pebbles; slight effervescence; mildly alkaline; abrupt, wavy boundary.

IIC—29 to 60 inches, grayish brown (10YR 5/2) gravelly sand; single grained; loose; 25 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum ranges from 24 to 40 inches and corresponds to the depth to the IIC horizon. Reaction generally ranges from medium acid to neutral, except for the lower few inches, which range to mildly alkaline.

The Ap horizon is very dark grayish brown (10YR 3/2) or grayish brown (10YR 4/2). It is light brownish gray (10YR 6/2) dry. The content of pebbles and cobblestones ranges from 1 to 15 percent.

Texture in the B2 horizon is loamy sand, heavy loamy sand, sandy loam, fine sandy loam, or sandy clay loam. The content of pebbles and cobblestones ranges from 1 to 25 percent. The B3 horizon is dark brown (7.5YR 4/4) or yellowish brown (10YR 5/4, 5/6) fine sandy loam, sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand. The content of pebbles and cobblestones is 5 to 25 percent.

The IIC horizon is grayish brown (10YR 5/2), brown (10YR 5/3), pale brown (10YR 6/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4) gravelly sand or sand. The content of pebbles and cobblestones ranges from 1 to 35 percent.

Boyer soils in most landscapes are near Gilford, Spinks, and Wasepi soils. They are browner in the B2 horizon than Gilford soils, have a finer textured Bt horizon than Spinks soils, and have better natural drainage than Wasepi soils.

BnB—Boyer loamy sand, 0 to 6 percent slopes. This soil is in irregularly shaped, slightly convex areas that are about 5 to 90 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils on the tops of rises or knolls where the depth to the substratum is greater than 40 inches. Also included are small areas of Wasepi soils on the foot slopes of convex slopes or in natural drainageways, and small areas of a well drained soil that is similar to the Boyer soil but has a sandy loam surface layer. Some short scattered slopes greater than 6 percent and small areas of wetter soils are identified by spot symbols on the soil map.

The main concerns of management are controlling soil blowing, conserving soil moisture, and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. Most areas are idle. Some areas are cropped, a few are used as a source of gravel, and some are used as building sites (fig. 12). Capability unit IIIs–1 (4a) ; woody plant group 3.

BnC—Boyer loamy sand, 6 to 12 percent slopes. This soil is in long or irregularly shaped, convex areas about 3 to 100 acres in size. It has a profile similar to that described as representative of the series, but the surface layer is thinner and yellowish brown in many places.

Included with this soil in mapping are small areas of soils on the tops of rises or knolls where the depth to the substratum is greater than 40 inches. Also included are small areas of Wasepi soils on foot slopes or in natural drainageways and small areas of a well drained soil that is similar to the Boyer soil but has a sandy loam surface layer. Some short scattered slopes greater than 12 percent, small areas of wetter soils, and excavated areas are identified by spot symbols on the soil map.

The main problems of management are controlling soil blowing and water erosion, conserving soil moisture, and maintaining the supply of organic matter.

This soil is suited to crops commonly grown in the county. Most areas are idle. A few areas are cropped, and some are in woodland or in nonfarm uses. Capability unit IIIe–4 (4a) ; woody plant group 3.

Cohoctah Series

The Cohoctah series consists of poorly drained, nearly level soils along the bottom land of streams and rivers. These soils formed in loamy alluvium.

In a representative profile, the surface layer is very dark gray fine sandy loam 13 inches thick. The underlying material, at a depth of 13 inches, consists of layers of grayish brown fine sandy loam, loamy fine sand, sand, sand and gravel, and black fine sandy loam.

Permeability is moderately rapid. The available water capacity is moderate. Runoff is very slow, or ponded.

Figure 12.—Gravel pit in area of Boyer loamy sand.

Cohoctah soils are generally not suited to crops commonly grown in the county because of wetness and flooding. They are suited to woodland. In many areas they are idle. In some areas they provide wildlife habitat, parks, or picnic grounds.

Representative profile of Cohoctah fine sandy loam, frequently flooded, in a wooded area, 1,370 feet west and 230 feet south of the northeast corner of sec. 10, T. 1 S., R. 8 E.

A1—0 to 13 inches, very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; moderate, medium, granular structure; very friable; many fine roots; mildly alkaline; clear, smooth boundary.

C1g—13 to 22 inches, grayish brown (10YR 5/2) fine sandy loam with few 1/16 inch lenses of silt; common, fine, prominent, yellowish red (5YR 5/6) mottles and many, medium, prominent, yellowish brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; very friable; few fine roots; mildly alkaline; clear, wavy boundary.

C2g—22 to 32 inches, grayish brown (10YR 5/2) loamy fine sand with few 1/16 inch lenses of silt; common, medium, prominent, yellowish brown (10YR 5/6) and yellowish red (5YR 5/6) mottles; weak, coarse, subangular blocky structure; very friable; few fine roots; mildly alkaline; clear, wavy boundary.

C3g—32 to 45 inches, grayish brown (2.5Y 5/2) sand with few 1/16 inch lenses of sandy loam and silt; common, medium, prominent, very dark grayish brown (10YR 3/2) mottles; single grained; loose; mildly alkaline; slight effervescence; clear, smooth boundary.

C4g—45 to 53 inches, black (10YR 2/1) fine sandy loam; common, medium, distinct, grayish brown (10YR 5/2) mottles; weak, thin, platy structure; very friable; slight effervescence; mildly alkaline; abrupt, smooth boundary.

C5g—53 to 60 inches, grayish brown (10YR 5/2) sand and gravel; single grained; loose; 30 to 40 percent pebbles; strong effervescence; mildly alkaline.

Reaction is neutral to mildly alkaline in the upper part of the soil and mildly alkaline or moderately alkaline below a depth of 30 inches. Effervescence ranges from none to strong.

The A1 horizon is very dark gray (10YR 3/1), black (10YR 2/1), or very dark grayish brown (10YR 3/2).

The Cg horizon has hue of 10YR and 2.5Y, value of 2, 5 or 6, and chroma of 1 or 2. It is chiefly alternating layers of sandy loam, fine sandy loam, or loamy fine sand, but it also has thin layers and lenses of sand, silt loam, silt, and sand and gravel. The content of pebbles ranges from the typical 0 percent to 40 percent in the sand and gravel horizon.

Cohoctah soils in most landscapes are near Shoals and Sloan soils. They have less clay than Shoals and Sloan soils in the upper 40 inches and are grayer than Shoals soils in the first horizon below the A horizon.

Cc—Cohoctah fine sandy loam, frequently flooded. This soil is in long, broad to narrow areas on flood

plains. These areas range from 40 to 80 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Shoals soils on slight rises and areas of soils, on slightly higher rises, that are similar but somewhat poorly drained. Also included are small areas of Sloan soils in lower depressions, many small areas of soils that are slightly effervescent on the surface or within 20 inches of the surface, and small areas of soils in isolated depressions that have a muck surface layer.

This soil is subject to flooding. Some low depressional areas are ponded by runoff from adjacent areas. The main concerns of management are removing excess water and controlling flooding.

Some areas of this soil are suited to crops if drained and protected from flooding. This soil is also suited to some recreational and park uses. Many areas are idle. Some provide wildlife habitat, parks, or picnic grounds. Capability unit Vw–1 (L–2c) ; woody plant group 5.

Corunna Series

The Corunna series consists of poorly drained, nearly level soils on lake plains and till plains. These soils formed in 20 to 40 inches of sandy and loamy material underlain by loamy material.

In a representative profile, the surface layer is very dark gray fine sandy loam 11 inches thick. The subsoil is 8 inches of gray, friable fine sandy loam mottled with dark gray; 6 inches of grayish brown, friable sandy loam mottled with yellowish brown and gray; and 9 inches of very friable loamy sand mottled with yellowish brown. The underlying material, at a depth of 34 inches, is grayish brown silty clay loam mottled with yellowish brown and gray.

Permeability is moderate in the subsoil and moderately slow in the underlying material. The available water capacity is high. Runoff is very slow or ponded.

Corunna soils are suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated. The rest is wooded, in nonfarm uses, or idle.

Representative profile of Corunna fine sandy loam, in a cultivated field, 700 feet east and 2,170 feet north of the southwest corner of sec. 1, T. 3 S., R. 8 E.

Ap—0 to 11 inches, very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; strong, medium, granular structure; friable; many fine roots; 1 percent pebbles; neutral; abrupt, smooth boundary.

B21g—11 to 19 inches, gray (10YR 5/1) fine sandy loam; common, medium, distinct, dark gray (10YR 5/1) mottles; moderate, medium, subangular blocky structure; friable; common fine roots; 1 percent pebbles; neutral; clear, wavy boundary.

B22g—19 to 25 inches, grayish brown (10YR 5/2) sandy loam; common, medium, distinct, yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; moderate, medium, subangular blocky structure; friable; few fine roots; 2 percent pebbles; neutral; abrupt, wavy boundary.

B3g—25 to 34 inches, grayish brown (10YR 5/2) loamy sand; common, medium, distinct, yellowish brown (10YR 5/6) mottles; weak, medium, granular structure; very friable; 5 percent pebbles; slight effervescence; mildly alkaline; abrupt, wavy boundary.

IICg—34 to 60 inches, grayish brown (10YR 5/2) silty clay loam; common, medium, distinct, yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; massive; firm; 5 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum is 25 to 40 inches, which is the depth to the IICg horizon. Reaction is slightly acid to neutral in the Ap horizon and neutral to mildly alkaline throughout the rest of the solum. The content of pebbles ranges to 5 percent. Few cobbles or boulders are present.

The Ap horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or black (10YR 2/1).

The B2g horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is sandy loam, heavy sandy loam, fine sandy loam, or loamy sand. The B3g horizon is absent in some pedons. If present, it is light gray (10YR 6/1), light brownish gray (10YR 6/2), or grayish brown (10YR 5/2) sandy loam or loamy sand.

The IICg horizon is gray (10YR 5/1), grayish brown (2.5Y 5/2, 10YR 5/2), light gray (10YR 6/1), or dark brown (10YR 4/3) silty clay loam or clay loam.

Corunna soils in most landscapes are near Belleville, Metamora, Pewamo, and Selfridge soils. They are loamy throughout the profile in contrast with Belleville soils. They are grayer in the solum than Metamora and Selfridge soils and are coarser textured in the subsoil than Pewamo soils.

Co—Corunna fine sandy loam. This soil is in irregularly shaped, low, flat areas that range from about 3 to 100 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained Metamora sandy loam on slightly higher knolls and ridges. Also included are small areas of Belleville soils, areas of Selfridge soils on small knolls and ridges, and small areas of soils that have more clay in the underlying material. Small areas of soils that have a mucky surface layer, areas of marshy soils, and excavated areas are identified by spot symbols on the soil map.

Some low depressional areas of this soil are subject to flooding by runoff from adjacent areas. Soil blowing is a hazard if the soil is dry. The main concern of management is removing excess water.

This soil is well suited to crops commonly grown in the county. If drained, it is also well suited to specialty crops. Most areas are cropped. Some are idle, or in nonfarm uses. Capability unit IIw–4 (3/2c) ; woody plant group 5.

Cut and Fill Land

Cut and fill land (Cu) consists of areas that have been cut and filled. The original soils are impossible to identify because of mechanical mixing. The higher ridges have been leveled to fill in the lower, poorly drained depressions and potholes. Some of these depressions and potholes have been leveled by soil material borrowed from nearby construction sites. Texture of the material ranges from sand to clay. The only sign of soil formation is a slight darkening at the surface caused by grass roots and decaying vegetation. Most of these areas are slightly to strongly effervescent at the surface.

Areas of Cut and fill land are used mainly as sites for recreational, industrial, and residential development. Some areas are idle or used for wildlife habitat and a few areas contain small deposits of rubbish and garbage. Onsite investigation is needed before any use is made of this land type. Not assigned to a capability unit or woody plant group.

Edwards Series

The Edwards series consists of very poorly drained, nearly level soils in swamps, along waterways, and in depressions in uplands of moraines and outwash plains. These soils formed in 16 to 49 inches of mixed woody and fibrous organic material underlain by marl.

In a representative profile, the upper 27 inches is black, friable muck. The upper 8 inches of underlying material is mixed white marl and black muck. Below this, at a depth of 35 inches, is light brownish gray and grayish brown marl.

Permeability is rapid in the muck and variable in the marl. The available water capacity is very high. Runoff is very slow. The water table is at or near the surface most of the year.

Edwards soils, if drained, are suited to crops commonly grown in the county. They are not suited to woodland, but they are suited to wildlife habitat. Most areas are pastured or idle.

Representative profile of Edwards muck, in pastured bog, 888 feet north and 969 feet east of the southwest corner of sec. 17, T. 1 S., R. 8 E.

Oa1—0 to 7 inches, black (10YR 2/1 broken face, rubbed and pressed) sapric material; about 5 percent fibers, less than 5 percent rubbed; moderate, medium, granular structure; friable; many fine roots; herbaceous fibers; mildly alkaline; abrupt, wavy boundary.

Oa2—7 to 16 inches, black (5YR 2/1 broken face and rubbed) sapric material, dark reddish brown (5YR 3/3 pressed); about 10 percent fibers, less than 5 percent rubbed; moderate, medium, subangular blocky structure; friable; common fine roots; herbaceous fibers; neutral; clear, wavy boundary.

Oa3—16 to 27 inches, black (10YR 2/1 broken face, rubbed and pressed) sapric material; about 10 percent fibers, less than 5 percent rubbed; moderate, coarse, subangular blocky structure; friable; few fine roots; herbaceous fibers; neutral; abrupt, wavy boundary.

IILca&Oa4—27 to 35 inches, white (10YR 8/2) marl and black (10YR 2/1 broken face, rubbed and pressed) sapric material; about 5 percent fibers, less than 5 percent rubbed; massive; friable; herbaceous fibers and marine shells; mildly alkaline; slight effervescence; clear, wavy boundary.

IILca—35 to 60 inches, light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) marl; massive; friable; strong effervescence; mildly alkaline.

Depth to the IILca horizon ranges from 16 to 49 inches, but is dominantly 16 to 40 inches. Reaction in the organic material ranges from medium acid to mildly alkaline. The organic part of the control section is dominantly sapric material. The content of coarse woody fragments, consisting of buried twigs, branches or logs, is 5 to 10 percent by volume in some pedons. Snail shells are commonly in the organic layers immediately above the marl and are throughout some pedons.

The surface tier is very dark brown (10YR 2/2) or black (10YR 2/1) on broken faces and rubbed. The percentage of rubbed fibers is less than 10 percent.

The subsurface and bottom tiers are black (5YR or 10YR 2/1), very dark brown (10YR 2/2), or dark reddish brown (5YR 2/2).

The IILca horizon is white (10YR 8/1, 8/2), grayish brown (2.5Y or 10YR 5/2), light brownish gray (10YR 6/2), or light gray (10YR 7/1). There is at least 6 inches of marl present. In some pedons, sandy material is below the marl in the control section.

Edwards soils in most landscapes are near Houghton soils. They are 16 to 49 inches deep over marl, whereas in Houghton soils the muck extends to a depth of more than 51 inches.

Ed—Edwards muck. This soil is in irregularly shaped areas in swamps, along drainageways, and in depressions in the uplands. Areas are about 3 to 20 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Houghton muck more than 51 inches thick, and small areas of muck over sandy or loamy material near the edges of this mapping unit.

This soil is subject to frequent flooding by runoff from adjacent areas. The main concerns of management are removing excess water and controlling soil blowing.

If drained, this soil is suited to crops commonly grown in the county. If drained and irrigated, it is also suited to shallow-rooted specialty crops. Most areas are idle or pastured. Capability unit IVw-1 (M/mc); woody plant group 1.

Gilford Series

The Gilford series consists of very poorly drained, nearly level soils on outwash plains, deltas, and lake plains. These soils formed in sandy, loamy, and gravelly glaciofluvial deposits.

In a representative profile, the surface layer is very dark gray sandy loam 10 inches thick. The subsoil is 8 inches of gray, very friable sandy loam mottled with yellowish brown and very dark gray; 7 inches of grayish brown, friable sandy loam mottled with yellowish brown; and 13 inches of light gray, very friable loamy sand. The underlying material, at a depth of 38 inches, is grayish brown gravelly sand.

Permeability is moderately rapid. The available water capacity is low. Runoff is very slow or ponded.

Gilford soils are suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated, and in some areas specialty crops are grown. The rest is wooded or idle.

Representative profile of Gilford sandy loam, in a cultivated field, 177 feet north and 615 feet west of the southeast corner of NE1/4 sec. 32, T. 3 S., R. 8 E.

Ap—0 to 10 inches, very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; moderate, medium, granular structure; friable; many fine roots; 5 to 10 percent pebbles; medium acid; abrupt, smooth boundary.

B1g—10 to 18 inches, gray (10YR 5/1) sandy loam; common, medium, faint, grayish brown (10YR 5/2) mottles and common, medium, distinct, yellowish brown (10YR 5/4) and very dark gray (10YR 3/1) mottles; weak, medium, granular structure; very friable; few fine roots; 5 percent pebbles; slightly acid; clear, wavy boundary.

B2g—18 to 25 inches, grayish brown (10YR 5/2) sandy loam; common, medium, distinct, yellowish brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; friable; few fine roots; 10 percent pebbles; slightly acid; clear, wavy boundary.

B3g—25 to 38 inches, light gray (10YR 6/1) loamy sand; few, fine, faint, yellowish brown (10YR 5/4) mottles; weak, medium, granular structure; very friable; 15 percent pebbles; neutral; abrupt, wavy boundary.

IICg—38 to 60 inches, grayish brown (10YR 5/2) gravelly sand; single grained; loose; 45 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum ranges from 30 to 40 inches, which corresponds to the depth of the IIC horizon and the depth to carbonates. Reaction ranges from medium acid to neutral in the Ap horizon and slightly acid to neutral throughout the rest of the solum.

The Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The content of pebbles ranges from 1 to 10 percent.

The B1g horizon is gray (10YR 5/1), grayish brown (10YR 5/2) and (2.5Y 5/2), or light gray (10YR 6/1, 7/2) loamy sand, fine sandy loam, or sandy loam. It does not occur in some pedons. The content of pebbles is 1 to 5 percent. The B2g horizon is grayish brown (10YR 5/2) and (2.5Y 5/2), gray (10YR 5/1), or light gray (10YR 6/1) loamy sand, sandy loam, sandy clay loam, or clay loam. The content of pebbles is 1 to 10 percent. The B3g horizon is gray (10YR 5/1), light gray (10YR 6/1), or grayish brown (10YR 5/2) and (2.5Y 5/2) gravelly loamy sand, loamy sand, sandy loam, or gravelly clay loam. The content of pebbles is 1 to 20 percent. The Bg horizon is less than 10 inches of material as heavy as sandy clay loam or clay loam.

The IICg horizon has hue of 5Y, 10YR, and 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is gravelly sand, coarse sand, or sand. The content of pebbles ranges from 1 to 45 percent.

Gilford soils in most landscapes are near Boyer, Granby, Tedrow, and Wasepi soils. They are grayer in the B horizon than Boyer and Tedrow soils and have a finer textured B horizon than Granby and Tedrow soils. They are not so well drained as Wasepi soils.

Gf—Gilford sandy loam. This soil is in irregularly shaped, low, flat areas that are about 5 to 200 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Wasepi soils on slight rises and knolls and small depressional areas of soils underlain by loam or clay loam below 40 inches. Also included are small areas of poorly drained soils, in the northwestern part of the county, that have a loam surface layer and a gravelly loam subsoil and small areas of soils that have a loamy sand surface layer. Small areas of soils that have a mucky surface layer, areas of marshy soils, and excavated areas are identified by spot symbols on the soil map.

Some low depressional areas of this soil are subject to flooding for brief periods by runoff from adjacent areas. The main concerns of management are removing excess water and conserving moisture in drained soils in midsummer.

This soil is suited to crops commonly grown in the county. It is moderately well suited to specialty crops if drained and irrigated. Most areas are cropped. Some are in specialty crops. Some are idle or wooded. Capability unit IIIw-3 (4c) ; woody plant group 5.

Granby Series

The Granby series consists of poorly drained and very poorly drained, nearly level soils on outwash plains and lake plains. These soils formed in sandy material.

In a representative profile (fig. 13), the surface layer is very dark brown loamy fine sand 11 inches thick. The upper 8 inches of the subsoil is grayish brown, very friable fine sand mottled with dark gray, pale brown, and yellowish brown. The lower 10 inches is grayish brown, very friable fine sand mottled with dark gray. The underlying material, at a depth of 29 inches, is gray fine sand.

Permeability is rapid. The available water capacity is low. Runoff is very slow or ponded.

Figure 13.—**Profile of Granby loamy fine sand showing high water table in sandy textured material.**

Granby soils are suited to crops commonly grown in the county. They are also suited to woodland. Many areas are wooded, idle, or in specialty crops. The rest is cultivated.

Representative profile of Granby loamy fine sand, in a cultivated field, 54 feet north and 1,185 feet west of the southeast corner of NE1/4 sec. 31, T. 4 S., R. 8 E.

Ap—0 to 11 inches, very dark brown (10YR 2/2) loamy fine sand, grayish brown (10YR 5/2) dry; moderate, medium, granular structure; friable; many fine roots; neutral; abrupt, wavy boundary.

B1g—11 to 19 inches, grayish brown (10YR 5/2) fine sand; common, medium, distinct, dark gray (10YR 4/1), pale brown (10YR 6/3), and yellowish brown (10YR 5/6) mottles; weak, medium, platy structure; very friable; few fine roots; neutral; clear, irregular boundary.

B2g—19 to 29 inches, grayish brown (10YR 5/2) fine sand; common, medium, distinct, dark gray (10YR 4/1) mottles; weak, medium, platy structure; very friable; few fine roots; neutral; clear, wavy boundary.

Cg—29 to 60 inches, gray (10YR 5/1) fine sand; single grained; loose; neutral.

Thickness of the solum ranges from 28 to 52 inches. Depth to the calcareous C material ranges from 35 to more than 60 inches. Reaction below the A horizon is neutral to mildly alkaline.

The Ap horizon is dominantly very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2), but ranges to black (10YR 2/1 or N 2/0) or very dark gray (10YR 3/1).

The B1g horizon is grayish brown (2.5Y 5/2, 10YR 5/2) or dark gray (10YR 4/1) fine sand, sand, or loamy sand. The B2g horizon is light brownish gray (10YR 5/2 and 2.5Y 6/2) or grayish brown (10YR 5/2 and 2.5Y 5/2) fine sand or sand.

The Cg horizon is gray (10YR 5/1) or grayish brown (10YR 5/2 and 2.5Y 5/2) fine sand or sand.

Granby soils in most landscapes are near Belleville, Gilford, Oakville, Tedrow, and Thetford soils. Granby soils lack the loamy IICg horizon that is characteristic of Belleville soils. They have a coarser textured B horizon than Gilford soils and have more distinct mottles in the B horizon than Oakville soils. They lack the brown and yellowish brown colors in the B horizon that are characteristic of Tedrow and Thetford soils.

Gr—Granby loamy fine sand. This soil is in irregularly shaped, low, flat areas that are about 2 to 200 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Tedrow and Thetford soils on slight rises and knolls. Also included are small areas of poorly drained soils that have bands of loamy sand, sandy loam, or silty clay loam in the subsoil and small areas of soils that have a surface layer of sandy loam. Marshy areas and small areas of soils that have a shallow, mucky surface layer are identified by spot symbols on the soil map.

Some low depressional areas of this soil are subject to flooding for brief periods by runoff from adjacent areas. The main concerns of management are removing excess water, controlling soil blowing, conserving moisture in midsummer, and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops if drained and irrigated. Many areas are wooded or idle. In drained areas specialty crops and field crops are grown. Capability unit IIIw-3 (5c); woody plant group 5.

Houghton Series

The Houghton series consists of very poorly drained, nearly level soils in swamps, along waterways, and in depressions in the uplands of moraines and outwash plains. These soils formed in mixed woody and fibrous organic material that is deeper than 51 inches.

In a representative profile, the surface layer is black muck 10 inches thick. The underlying material is black or very dark grayish brown, friable muck.

Permeability is rapid. The available water capacity is very high. Runoff is very slow or ponded. The water table is at or near the surface most of the year.

Houghton soils, if drained, are suited to crops commonly grown in the county. They are not suited to woodland, but they are suited for wildlife habitat. Most areas are pastured or idle.

Representative profile of Houghton muck, in a pastured bog, 783 feet north and 1,041 feet east of the southwest corner of sec. 17, T. 1 S., R. 8 E.

Oa1—0 to 10 inches, black (10YR 2/1 broken face and rubbed) sapric material, very dark grayish brown (10 YR 3/2 pressed); about 15 percent fibers, less than 5 percent rubbed; moderate, medium, granular structure; friable; many fine roots; dominantly herbaceous fibers; neutral; abrupt, smooth boundary.

Oa2—10 to 20 inches, black (10YR 2/1 broken face and rubbed) sapric material, dark yellowish brown (10YR 3/4 pressed); about 15 percent fibers, less than 10 percent rubbed; moderate, very coarse, subangular blocky structure; friable; common fine roots; dominantly herbaceous fibers; neutral; gradual, wavy boundary.

Oa3—20 to 30 inches, black (10YR 2/1 broken face, rubbed and pressed) sapric material; about 15 percent fibers, less than 5 percent rubbed; moderate, coarse, subangular blocky structure; friable; common fine roots; dominantly herbaceous fibers; neutral; gradual, wavy boundary.

Oa4—30 to 42 inches, black (10YR 2/1 broken face, rubbed and pressed) sapric material; about 10 percent fibers, less than 5 percent rubbed; massive; friable; dominantly herbaceous fibers; neutral; gradual, wavy boundary.

Oa5—42 to 48 inches, black (10YR 2/1 broken face, rubbed and pressed) sapric material; about 10 percent fibers, less than 5 percent rubbed; massive; friable; dominantly herbaceous fibers; neutral; gradual, wavy boundary.

Oa6—48 to 60 inches, very dark grayish brown (10YR 3/2 broken face and rubbed) sapric material, dark yellowish brown (10YR 3/4 pressed); about 25 percent fibers, less than 10 percent rubbed; massive; friable; dominantly herbaceous fibers; mildly alkaline.

Thickness of organic deposits is more than 51 inches. The surface layer is black (10YR 2/1, 5YR 2/1) or very dark brown (10YR 2/2). It is dominantly sapric material. Reaction is neutral or mildly alkaline.

The subsurface layers have hue of 10YR or 5YR, value of 2 or 3, and chroma of 1 or 2. The content of coarse woody fragments, consisting of buried twigs, branches, or logs, is 5 to 10 percent by volume in some pedons. The subsurface layers are dominantly sapric material. Reaction is neutral or mildly alkaline.

Houghton soils in most landscapes are near Edwards soils. They are deep organic soils, whereas Edwards soils are underlain by marl at a depth of 16 to 49 inches.

Hn—Houghton muck. This soil is in irregularly shaped areas in swamps, along drainageways, and in depressions in the uplands. These areas are about 3 to 25 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Edwards muck where marl is within a depth of 49 inches. Also included are small areas of muck, near the edges of this unit, that is underlain by sandy or loamy material between depths of 16 and 51 inches and small areas of soils that have a surface layer, 4 to 12 inches thick, of washed-in mineral material.

This soil is subject to frequent flooding by runoff from adjacent areas. The main concerns of management are removing excess water and controlling soil blowing.

This soil, if drained, is suited to crops commonly grown in the county. If drained and irrigated, it is also suited to sod production and specialty crops. Most areas are idle or pastured. Capability unit IIIw-5 (Mc); woody plant group 1.

Hoytville Series

The Hoytville series consists of very poorly drained, nearly level soils on lake plains and till plains. These soils formed in clayey glacial till. On lake plains this fill has been slightly modified by former lake waters.

In a representative profile, the surface layer is very dark gray silty clay loam 9 inches thick. The upper 21 inches of the subsoil is gray, firm clay mottled with yellowish brown. The lower 8 inches is grayish brown, firm silty clay mottled with yellowish brown and light gray. The upper 12 inches of the underlying material is gray clay mottled with yellowish brown. The lower part, at a depth of 50 inches, is light gray clay mottled with light yellowish brown, brown, and dark yellowish brown.

Permeability is slow. The available water capacity is moderate. Runoff is very slow.

Hoytville soils are suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated. The rest is wooded, idle, or in nonfarm uses.

Representative profile of Hoytville silty clay loam, in an idle field, 726 feet west of the northeast corner of SE1/4 sec. 32, T. 4 S., R. 10 E.

Ap—0 to 9 inches, very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate, medium, angular blocky structure; firm; many fine roots; 1 percent pebbles; neutral; abrupt, smooth boundary.

B21tg—9 to 16 inches, gray (10YR 5/1) clay; common, medium, distinct, yellowish brown (10YR 5/6) mottles and few, fine, faint, dark gray (10YR 4/1) mottles; moderate, medium, columnar structure parting to moderate, medium, angular blocky; firm; few fine roots; 1 percent pebbles; neutral; gradual, wavy boundary.

B22tg—16 to 30 inches, gray (10YR 5/1) clay; common, medium, distinct, yellowish brown (10YR 5/6) mottles; moderate, medium, angular blocky structure; firm; many, thin, gray (10YR 5/1) clay films on surfaces of peds; few fine roots; 1 percent pebbles; mildly alkaline; gradual, wavy boundary.

B23tg—30 to 38 inches, grayish brown (10YR 5/2) silty clay; common, medium, distinct, yellowish brown (10YR 5/6) mottles and common, fine, distinct, light gray (10YR 6/1) mottles; moderate, medium, angular blocky structure; firm; many, thin, grayish brown (10YR 5/2) clay films on surfaces of peds; few fine roots; 1 percent pebbles; mildly alkaline; clear, wavy boundary.

C1g—38 to 50 inches, gray (10YR 5/1) clay; common, medium, distinct, yellowish brown (10YR 5/6) mottles; massive; firm; 2 percent pebbles; mildly alkaline; abrupt, wavy boundary.

C2g—50 to 60 inches, light gray (10YR 6/1) clay; common, medium, distinct, light yellowish brown (10YR 6/4), brown (7.5YR 5/2), and dark yellowish brown (10YR 4/4) mottles; massive; firm; 3 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum is 36 to 52 inches and corresponds to the depth to carbonates. Reaction is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. The content of pebbles throughout the solum is less than 5 percent.

The Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2).

The B horizon is gray (10YR 5/1, N 5/0), dark gray (10YR 4/1), very dark gray (N 3/1), or grayish brown (10YR 5/2) silty clay or clay.

The C horizon is gray (10YR 5/1), light gray (10YR 6/1), grayish brown (10YR 5/2), or yellowish brown (10YR 5/6) silty clay loam or clay. It is mildly or moderately alkaline. The content of pebbles is less than 5 percent.

Hoytville soils in most landscapes are near Blount, Nappanee, Pewamo, and St. Clair soils. They are grayer in the B horizon than Blount, St. Clair, and Nappanee soils and are finer textured in the B horizon than Pewamo soils.

Ho—Hoytville silty clay loam. This soil is in irregularly shaped, low, flat areas that range from about 5 to 500 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Nappanee soils on slightly higher rises or knolls. Also included are small areas of a somewhat poorly drained soil, on slightly higher rises, that has a sandy subsoil and small areas of soils that have a surface layer of loam or mucky silt loam. In Brownstown Township, south of Trenton, areas of soils that are slightly effervescent, mildly alkaline, and ponded are included.

Some low depressional areas of this soil are subject to flooding for brief periods by runoff from adjacent areas. The main concerns of management are removing excess water and maintaining soil tilth.

This soil is suited to crops commonly grown in the county. Most areas are cropped. A few areas are idle or wooded or pastured. Capability unit IIw-1 (1c); woody plant group 5.

Kibbie Series

The Kibbie series consists of somewhat poorly drained nearly level to gently sloping soils on lake plains, outwash plains, and deltas. These soils formed in stratified, waterlain sandy and loamy deposits.

In a representative profile, the surface layer is very dark grayish brown fine sandy loam 9 inches thick. The subsoil is 6 inches of yellowish brown, friable heavy silt loam mottled with grayish brown; 14 inches of brown, friable silty clay loam mottled with yellowish brown; and 9 inches of light brownish gray, friable silt loam mottled with yellowish brown. The underlying material, at a depth of 38 inches, is 12 inches of light yellowish brown stratified silt and very fine sand mottled with light brownish gray and yellowish brown; 5 inches of yellowish brown stratified silt and silt loam mottled with light brownish gray and light gray; and, at a depth of 55 inches, yellowish brown silt.

Permeability is moderate. The available water capacity is high. Runoff is slow.

Kibbie soils are suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated, and in some areas specialty crops are grown. The rest is wooded or in nonfarm uses.

Representative profile of Kibbie fine sandy loam, 0 to 3 percent slopes, in a cultivated field, 84 feet west and 1,677 feet north of the southeast corner of sec. 30, T. 2 S., R. 8 E.

Ap—0 to 9 inches, very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate, medium, granular structure; friable; common fine roots; 1 percent pebbles; neutral; abrupt, smooth boundary.

B1—9 to 15 inches, yellowish brown (10YR 5/4) heavy silt loam; common, medium, distinct, grayish brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; friable; dark grayish brown (10YR 4/2) organic stains; few fine roots; 1 percent pebbles; neutral; clear, wavy boundary.

B2t—15 to 29 inches, brown (10YR 5/3) silty clay loam; common, medium, distinct, yellowish brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; common, thin, discontinuous, grayish brown (10YR 5/2) clay films on surfaces of peds; few fine roots; 1 percent pebbles; neutral; clear, wavy boundary.

B3—29 to 38 inches, light brownish gray (10YR 6/2) silt loam; common, medium, distinct, yellowish brown (10YR 5/6) mottles; moderate, thick, platy structure; friable; few fine roots; neutral; abrupt, wavy boundary.

C1—38 to 50 inches, light yellowish brown (10YR 6/4), stratified silt and very fine sand; common, medium, distinct, light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak, thin, platy structure; friable; slight effervescence; mildly alkaline; abrupt, wavy boundary.

C2—50 to 55 inches, yellowish brown (10YR 5/6), stratified silt and silt loam; common, medium, distinct, light brownish gray (10YR 6/2) and light gray (10YR 7/2) mottles; weak, thin, platy structure; friable; strong effervescence: mildly alkaline; abrupt, wavy boundary.

C3—55 to 62 inches, yellowish brown (10YR 5/4) silt; weak, thin, platy structure; friable; strong effervescence; mildly alkaline.

Thickness of the solum ranges from 24 to 45 inches. Reaction ranges from medium acid to neutral in the upper 30 inches and neutral to mildly alkaline below. The content of pebbles throughout the solum is less than 2 percent.

The Ap horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1) fine sandy loam, silt loam, loamy very fine sand, or loamy sand.

The B1 horizon is yellowish brown (10YR 5/4, 5/6) or brown (10YR 5/3) fine sandy loam, loamy fine sand, heavy silt loam, or loamy very fine sand. It does not occur in all pedons. The B2t horizon is yellowish brown (10YR 5/4, 5/6) or brown (10YR 5/3) clay loam or silty clay loam. Some pedons have thin strata of very fine sandy loam. The B3 horizon is lacking in some pedons. It is light brownish gray (10YR 6/2), grayish brown (10YR 5/2), brown (10YR 5/3), or yellowish brown (10YR 5/4) silt loam or silty clay loam.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 6. It is stratified silty clay loam, silt loam, silt, fine sand, and very fine sand.

Kibbie soils in most landscapes are near Blount, Selfridge, or Pella soils. They differ from Blount soils in having a coarser textured B horizon. They are finer textured in the upper part of the B horizon than Selfridge soils, and they lack the gray color in the B horizon that is characteristic of Pella soils.

KnA—Kibbie fine sandy loam, 0 to 3 percent slopes. This soil is in irregularly shaped, convex areas that are about 3 to 90 acres in size.

Included with this soil in mapping are small areas of Pella soils in depressions and waterways, small areas of Wasepi soils, and areas of Metamora soils on the foot slopes of rises or knolls. Also included are small areas of Selfridge and Thetford soils on slightly higher ridges and small areas of soils that are underlain by silty clay loam at a depth of 45 to 60 inches. Small areas of wetter soils and excavated areas are identified by spot symbols on the soil map.

The main concerns of management are removing excess water and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops if drained and irrigated. Most areas are cropped. Some are in specialty crops. Some are idle, wooded, or in nonfarm uses. Capability unit IIw-3 (2.5b); woody plant group 2.

Made Land

Made land (Ma) consists of buried trash, garbage, and rubble. Areas range from about 2 to 80 acres in size. Most of these areas are excavated to or below the permanent water table and then refilled with alternate layers of refuse and soil material. Soil material ranges from sand to clay. Areas no longer used for dumping waste have been leveled and covered, and they are now idle. Some areas have potential as recreation sites, such as golf courses, play areas, and picnic areas. Because each area differs in composition, onsite investigation is needed before it is developed. Made land is not assigned a capability unit or woody plant group.

Marsh

Marsh (Mb) consists of level and depressed areas along the mouths of the Huron River and the Detroit River at their confluence with Lake Erie. In many areas the soils formed in alluvial mineral material, but in some they formed in organic material. These areas have standing water or a water table at or very near the surface throughout the year, and access is limited.

Marsh provides habitat for waterfowl and other aquatic and semiaquatic species of birds and mammals. The vegetation is cattails, reeds, grasses, and woody shrubs. Capability unit VIIIw-1; not assigned to a woody plant group.

Metamora Series

The Metamora series consists of somewhat poorly drained, nearly level or gently sloping soils on lake plains, till plains, and low moraines. These soils formed in 25 to 40 inches of sandy material and underlying loamy material.

In a representative profile, the surface layer is very dark grayish brown sandy loam 9 inches thick. The subsoil is 6 inches of pale brown, friable sandy loam mottled with yellowish brown; 11 inches of grayish brown, friable heavy sandy loam mottled with dark yellowish brown; and 3 inches of gray, firm silty clay loam mottled with yellowish brown. The underlying material, at a depth of 29 inches, is dark brown silty clay loam mottled with gray and yellowish brown.

Permeability is moderately rapid in the sandy or loamy upper part of the subsoil and moderately slow in the lower part and the underlying material. The available water capacity is high. Runoff is slow.

Metamora soils are well suited to crops commonly grown in the county. They are well suited to woodland. In many areas these soils are cultivated, and in some areas specialty crops are grown. The rest is wooded, idle, or in nonfarm uses.

Representative profile of Metamora sandy loam, 0 to 3 percent slopes, in a cultivated field, 93 feet east and 180 feet south of the northwest corner of SW1/4 sec. 18, T. 2 S., R. 8 E.

Ap—0 to 9 inches, very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; moderate, coarse, granular structure; friable; common fine roots; less than 5 percent pebbles and cobblestones; slightly acid; abrupt, smooth boundary.

B1—9 to 15 inches, pale brown (10YR 6/3) sandy loam; common, medium, distinct, yellowish brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; very dark grayish brown (10YR 3/2) worm casts; few fine roots; less than 5 percent pebbles and cobblestones; neutral; clear, wavy boundary.

B21tg—15 to 26 inches, grayish brown (10YR 5/2) heavy sandy loam; common, medium, distinct, dark yellowish brown (10YR 4/4) mottles; fine, irregularly shaped, very dark brown (10YR 2/2) iron and manganese concretions; moderate, medium, subangular blocky structure; friable; common, thin, dark brown (10YR 3/3) clay films on surfaces of peds; few fine roots; less than 5 percent pebbles and cobblestones; neutral; abrupt, wavy boundary.

IIB22tg—26 to 29 inches, gray (10YR 5/1) silty clay loam; common, medium, distinct, yellowish brown (10YR 5/6) mottles; moderate, medium, angular blocky structure; firm; continuous, thin, gray (10YR 5/1) clay films on surfaces of peds; few fine roots; less than 5 percent pebbles and cobblestones mildly alkaline; abrupt, wavy boundary.

IIC—29 to 60 inches, dark brown (10YR 4/3) silty clay loam; common, medium, distinct, gray (10YR 5/1) and

yellowish brown (10YR 5/6) mottles; massive; firm; less than 5 percent pebbles and cobblestones; slight effervescence; mildly alkaline.

Thickness of the solum is 24 to 40 inches and corresponds to the depth of the IIC horizon. Reaction ranges from slightly acid to mildly alkaline in the upper part and neutral to mildly alkaline in the lower part. The content of pebbles and cobblestones throughout the solum is 1 to 8 percent.

The Ap horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1).

The B1 horizon is pale brown (10YR 6/3), brown (10YR 5/3), or yellowish brown (10YR 5/4) sandy loam, loamy sand, or loamy fine sand. The B2 horizon is grayish brown (10YR 5/2 or 2.5Y 5/2), or yellowish brown (10YR 5/4, 5/6) with continuous grayish brown (10YR 5/2) clay films. It is heavy sandy loam, sandy loam, sandy clay loam, or clay loam. The IIB horizon is gray (10YR 5/1), grayish brown (10YR 5/2), or yellowish brown (10YR 5/4, 5/6) sandy clay loam, clay loam, or silty clay loam.

The IIC horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is silty clay loam, clay loam, or stratified silt and silty clay loam.

Metamora soils in most landscapes are near Owosso, Metea, Corunna, and Blount soils. They are grayer in the B horizon than Owosso and Metea soils. They are less gray in the B horizon than Corunna soils, and they are coarser textured in the upper part of the B horizon than Blount soils.

MeA—Metamora sandy loam, 0 to 3 percent slopes. This soil is in irregularly shaped, convex areas that are about 4 to 50 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Blount soils on slightly lower flat areas and small areas of Corunna and Pewamo soils in small waterways and concave depressions. Also included are small areas of Selfridge soils, some areas of soils that have less than 24 inches of sandy loam material, and small areas of soils that have a surface layer of loamy sand or loamy fine sand. Small areas of wetter soils and excavated areas are identified by spot symbols on the soil map.

The main concerns of management are removing excess water, preventing soil blowing during dry periods, and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops if drained and irrigated. Most areas are cropped. In some areas specialty crops are grown. Some are idle, wooded, or in nonfarm uses. Capability unit IIw-4 (3/2b); woody plant group 2.

MfA—Metamora-Pewamo complex, 0 to 3 percent slopes. This mapping unit is on broad plains. It is about 60 percent Metamora sandy loam, about 20 percent Pewamo loam, and about 20 percent minor soils. Metamora sandy loam is on mounds and ridges. Pewamo loam is in oblong depressions and other areas generally 2 to 4 feet lower than the adjacent areas of Metamora sandy loam. Areas range from about 40 to 300 acres in size.

Included with this unit in mapping are small areas of the Metea and the Wasepi loamy substratum soils on slightly higher ridges and knolls, small areas of Blount soils on side slopes, and small areas of Pella and Corunna soils in depressions. Also included are small areas of soils that have a muck surface layer 6 to 8 inches thick and areas of soils along major drainageways where slope is 4 to 5 percent.

Soil blowing is a limitation on Metamora sandy loam, and poor tilth is a limitation on Pewamo loam. Some of the low depressional areas in this mapping unit are subject to flooding by runoff from adjacent areas. The main concerns of management are removing excess water, controlling soil blowing, and maintaining tilth and organic-matter content.

This mapping unit is suited to crops commonly grown in the county. Many areas are idle or wooded, and some areas are cropped. Capability unit IIw–4 (3/2b, 1.5c); woody plant group 2.

Metea Series

The Metea series consists of well drained, nearly level or gently sloping soils on lake plains, moraines, and till plains. These soils formed in 24 to 40 inches of sandy material and the underlying loamy glacial till.

In a representative profile, the surface layer is very dark grayish brown loamy sand 9 inches thick. The subsoil is 14 inches of dark yellowish brown, very friable loamy sand and 10 inches of light yellowish brown and yellowish brown, loose fine sand and very friable sandy loam mottled with yellowish brown. The underlying material, at a depth of 35 inches, is brown silty clay loam mottled with dark yellowish brown, yellowish brown, and gray.

Permeability is very rapid in the sandy or loamy upper part of the subsoil and moderate in the lower part and the underlying material. The available water capacity is moderate. Runoff is very slow.

Metea soils are moderately well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are idle or wooded. The rest is cultivated or in nonfarm uses.

Representative profile of Metea loamy sand, 2 to 6 percent slopes, in a cultivated field, 153 feet west and 1,491 feet north of the center of sec. 29, T. 4 S., R. 9 E.

Ap—0 to 9 inches, very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak, medium, granular structure; very friable; abundant very fine roots; 2 percent pebbles; slightly acid; abrupt, wavy boundary.

B1—9 to 23 inches, dark yellowish brown (10YR 4/4) loamy sand; common, medium, distinct, dark yellowish brown (10YR 3/4) mottles; weak, medium, angular blocky structure; very friable; few very fine roots; 1 percent pebbles; neutral; gradual, wavy boundary.

B21—23 to 31 inches, light yellowish brown (10YR 6/4) fine sand; common, medium, distinct, yellowish brown (10YR 5/6) mottles; single grained; loose; few very fine roots; 1 percent pebbles; neutral; abrupt, wavy boundary.

B22t—31 to 33 inches, yellowish brown (10YR 5/6) sandy loam; weak, medium, subangular blocky structure; very friable; few very fine roots; 1 percent pebbles; neutral; abrupt, wavy boundary.

IIB23tg—33 to 35 inches, gray (10YR 5/1) clay loam; common, medium, distinct, dark yellowish brown (10YR 4/4) and brown (7.5YR 5/2) mottles; strong, medium, angular blocky structure; firm; many, thin, grayish brown (10YR 5/2) clay films on surface of peds; few very fine roots; 2 percent pebbles; neutral; clear, wavy boundary.

IIC—35 to 60 inches, brown (7.5YR 5/2) silty clay loam; common, medium, distinct, yellowish brown (10YR 5/6), gray (10YR 5/1), and dark yellowish brown (10YR 4/4) mottles; massive; firm; 5 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum is 24 to 48 inches, and thickness of the loamy sand or sand upper horizons is 20 to 40 inches. Reaction ranges from slightly acid to neutral in the upper 33 inches and neutral to mildly alkaline below. The content of pebbles and cobblestones throughout the solum is 1 to 8 percent.

In undisturbed areas the soil has a 1- to 4-inch A1 horizon that is very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) loamy sand and has weak, fine, granular structure. The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2).

The B1 horizon is yellowish brown (10YR 5/4, 5/6), light yellowish brown (10YR 6/4), or dark yellowish brown (10YR 4/4) loamy sand or sand. The B21 horizon is yellowish brown (10YR 5/4, 5/6), brownish yellow (10YR 6/6), or light yellowish brown (10YR 6/4) loamy sand, fine sand, or sand. The B22t horizon is yellowish brown (10YR 5/4, 5/6) or pale brown (10YR 6/3) loamy sand or sandy loam. The IIB23tg horizon has hue of 10YR and 2.5Y, value of 5 or 6, and chroma of 1 to 4. It is clay loam or silty clay loam.

The IIC horizon is yellowish brown (10YR 5/6), brown (7.5YR 5/2), light olive brown (2.5Y 5/4, 5/6), light gray (10YR 6/1), or light brownish gray (10YR 6/2) silty clay loam or clay loam.

This soil has a thinner loamy B horizon than is defined as the range for the series, but this difference does not alter use or management.

Metea soils in most landscapes are near Oakville and Metamora soils. Unlike Oakville soils, they are underlain with loamy material at a depth of 24 to 48 inches. They are better drained than Metamora soils.

MhB—Metea loamy sand, 2 to 6 percent slopes. This soil is in irregularly shaped, convex areas that are 5 to 40 acres in size.

Included with this soil in mapping are a few small areas of Owosso soils, areas of Selfridge soils in small depressions or waterways, and small areas of Morley soils near major drainageways. Also included are areas of soils on the tops of rises and ridges, where slope is less than 2 percent. Areas of soils where slope is greater than 6 percent and small areas of wetter soils are identified by spot symbols on the soil map.

The main concerns of management are controlling soil blowing, conserving soil moisture during dry periods, and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. Many areas are idle or wooded. Some areas are cropped, and some are in nonfarm uses. Capability unit IIIe-3 (4/2a) ; woody plant group 3.

Morley Series

The Morley series consists of well drained or moderately well drained, gently sloping to strongly sloping soils on till plains and moraines. These soils formed in loamy and clayey glacial till.

In a representative profile, the surface layer is very dark grayish brown loam 8 inches thick. The upper 5 inches of the subsoil is yellowish brown, firm clay loam mottled with brown. The lower 13 inches is dark yellowish brown, firm clay. The underlying material, at a depth of 26 inches, is brown, slightly effervescent clay loam mottled with yellowish brown.

Permeability is moderately slow. The available water capacity is high. Runoff is slow in gently sloping areas to rapid in strongly sloping areas.

Morley soils are well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are wooded or idle. The rest is pastured or in nonfarm uses.

Representative profile of Morley loam, 2 to 6 percent slopes, in a cultivated field, 1,100 feet north and 945 feet west of the center of sec. 30, T. 1 S., R. 8 E.

Ap—0 to 8 inches, very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate, medium, granular structure; friable; many fine roots; 2 percent pebbles and cobblestones; neutral; abrupt, smooth boundary.

B21t—8 to 13 inches, yellowish brown (10YR 5/6) clay loam; common, medium, distinct, brown (10YR 5/3) mottles; moderate, medium, subangular blocky structure; firm, continuous, thin, pale brown (10YR 6/3) clay films on surfaces of peds; very dark grayish brown (10YR 3/2) root channels and worm casts; few fine roots; 5 percent pebbles and cobblestones; mildly alkaline; clear, wavy boundary.

B22t—13 to 26 inches, clay having dark yellowish brown (10YR 4/4) ped interiors, pale brown (10YR 6/3) ped exteriors; moderate, medium, prismatic structure parting to moderate, medium, angular blocky; firm, continuous, moderately thick, brown (10YR 5/3) clay films on surfaces of peds; few fine roots to a depth of 20 inches, none below; 5 percent pebbles and cobblestones; mildly alkaline; abrupt, wavy boundary.

C—26 to 60 inches, brown (10YR 5/3) clay loam; common, medium, distinct, yellowish brown (10YR 5/6) mottles; massive; firm; light gray (10YR 7/1) lime streaks; 5 percent pebbles and cobblestones; slight effervescence; mildly alkaline.

Thickness of the solum is typically 20 to 30 inches, but ranges from 20 to 40 inches and corresponds to depth of free carbonates. Reaction ranges from medium acid to mildly alkaline. The content of pebbles and cobblestones throughout the solum is 1 to 10 percent.

The Ap horizon is very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), or dark brown (10YR 4/3).

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, clay, or silty clay loam.

The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4) clay loam or silty clay loam. The content of cobblestones ranges from 5 to 10 percent.

Morley soils in most landscapes are near Blount, Owosso, Pewamo, and St. Clair soils. They have better natural drainage than Blount soils. They lack the sandy loam upper part of the B horizon that is characteristic of Owosso soils and the gray color that is characteristic of Pewamo soils. They are not so fine textured in the underlying material as St. Clair soils.

MoB—Morley loam, 2 to 6 percent slopes. This soil is in irregularly shaped, convex areas that range from 3 to 30 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Owosso soils on slightly higher rises or on the tops of knolls and areas of Blount soils in small depressions or in natural waterways. Small scattered areas of soils where slope is greater than 6 percent, small areas of wetter soils, and excavated areas are identified by spot symbols on the soil map.

The main concerns of management are controlling soil erosion and maintaining organic-matter content and tilth.

This soil is suited to crops commonly grown in the county. Many areas are idle or wooded. Some areas are cropped, and a few areas are in nonfarm uses. Capability unit IIe-1 (1.5a) ; woody plant group 4.

MoC—Morley loam, 6 to 12 percent slopes. This soil is in irregularly shaped, convex areas that range from 3 to 40 acres in size. This soil has a profile similar to

that described as representative of the series, but the subsoil is thinner as a result of mixing with the surface layer.

Included with this soil in mapping are small areas of Owosso soils on slightly higher knolls or on the tops of knolls and areas of Blount soils in small depressions or in natural waterways. Also included are small areas of eroded soils on the tops of knolls that have a surface layer of clay loam. Small scattered areas of soils where slope is greater than 12 percent and small areas of wet soils are identified by spot symbols on the soil map.

The main concerns of management are controlling soil erosion and maintaining organic-matter content and tilth.

This soil is suited to crops commonly grown in the county. Many areas are idle or wooded. Some areas are cropped, and a few areas are in nonfarm uses. Capability unit IIIe-3 (1.5a); woody plant group 4.

MoD—Morley loam, 12 to 18 percent slopes. This soil is in irregularly shaped, convex areas that range from 3 to 30 acres in size. This soil has a profile similar to that described as representative of the series, but part of the original surface layer has been lost through erosion.

Included with this soil in mapping are small areas of Owosso soils on slightly higher knolls or on the tops of knolls and areas of Blount soils in small depressions and along natural waterways. Also included are small areas of eroded soils on the tops of knolls where the surface layer is clay loam and areas of soils on the tops of hills and on foot slopes where slope is less than 12 percent. Small scattered areas of soils where slope is greater than 18 percent and small areas of wet soils are identified by spot symbols on the soil map.

Runoff is rapid. The main concerns of management are controlling soil erosion and maintaining organic-matter content and tilth.

This soil is suited to crops commonly grown in the county, but it is too steep to be cropped intensively. Many areas are idle or are wooded or pastured. A few areas are cropped, and some are in nonfarm uses. Capability unit IVe-1 (1.5a); woody plant group 4.

Nappanee Series

The Nappanee series consists of somewhat poorly drained, nearly level to gently sloping soils on lake plains and till plains. These soils formed in clayey glacial till material. On lake plains this material has been slightly modified by former lake waters.

In a representative profile, the surface layer is dark grayish brown silt loam 7 inches thick. The subsoil is 4 inches of yellowish brown, firm clay mottled with grayish brown; 13 inches of grayish brown, firm clay mottled with yellowish brown; and 5 inches of grayish brown, firm clay mottled with yellowish brown and brown. The underlying material, at a depth of 29 inches, is 11 inches of gray clay mottled with yellowish brown and brown; 5 inches of light gray silty clay mottled with light olive brown; and, at a depth of 45 inches, gray clay mottled with brown and yellowish brown.

Permeability is very slow. The available water capacity is moderate. Runoff is slow.

Nappanee soils are moderately well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated. The rest is wooded, idle, or in nonfarm uses.

Representative profile of Nappanee silt loam, 0 to 4 percent slopes, in a cultivated field, 1,300 feet west and 450 feet south of the northeast corner of sec. 33, T. 4 S., R. 10 E.

Ap—0 to 7 inches, dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate, medium, granular structure; friable; common fine roots; 2 percent pebbles; slightly acid; abrupt, smooth boundary.

B21t—7 to 11 inches, yellowish brown (10YR 5/6) clay; common, medium, distinct, grayish brown (10YR 5/2) mottles; moderate, medium, angular blocky structure; firm; few fine roots; 2 percent pebbles; neutral; clear, wavy boundary.

B22tg—11 to 24 inches, grayish brown (10YR 5/2) clay; common, medium, distinct, yellowish brown (10YR 5/6) and few, fine, faint, gray (10YR 5/1) mottles; moderate, medium, prismatic structure parting to moderate, medium, angular blocky; firm; continuous, thin, grayish brown (10YR 5/2) clay films on surfaces of peds; few fine roots; 3 percent pebbles; mildly alkaline; abrupt, wavy boundary.

B23tg—24 to 29 inches, grayish brown (10YR 5/2) clay; common, medium, distinct, brown (7.5YR 5/2) and yellowish brown (10YR 5/6) and few, fine, faint, gray (10YR 5/1) mottles; moderate, medium, prismatic structure parting to moderate, medium, angular blocky; firm; continuous, thin, grayish brown (10YR 5/2) clay films on surfaces of peds; few fine roots; 3 percent pebbles and cobblestones; slight effervescence; mildly alkaline; clear, wavy boundary.

C1g—29 to 40 inches, gray (10YR 5/1) clay; common, medium, distinct, yellowish brown (10YR 5/6) and brown (7.5YR 5/2) mottles; massive; firm; 4 percent pebbles and cobblestones; slight effervescence; mildly alkaline; abrupt, wavy boundary.

C2g—40 to 45 inches, light gray (10YR 6/1) silty clay; common, medium, distinct, light olive brown (2.5Y 5/4) mottles; massive; firm; slight effervescence; mildly alkaline; abrupt, wavy boundary.

C3g—45 to 60 inches, gray (10YR 5/1) clay; common, medium, distinct, brown (7.5YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; firm; 5 percent pebbles and cobblestones; slight effervescence; mildly alkaline.

Thickness of the solum is 20 to 35 inches. Depth to effervescent soil material is 20 to 32 inches. Reaction ranges from slightly acid to neutral in the upper part and neutral to mildly alkaline in the lower part. The content of pebbles and cobblestones throughout the solum is 0 to 5 percent.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 5/3).

The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is clay or silty clay. Very dark brown (10YR 2/2) concretions are in some pedons.

The C horizon is gray (10YR 5/1), light gray (10YR 6/1), grayish brown (10YR 5/2), yellowish brown (10 YR 5/6), or brownish yellow (10YR 6/6) clay or silty clay. The content of pebbles and cobblestones is less than 10 percent.

Nappanee soils in most landscapes are near Hoytville and St. Clair soils. They lack the dominant gray color in the B horizon that is characteristic of Hoytville soils, but they are grayer in the B horizon than St. Clair soils.

NaB—Nappanee silt loam, 0 to 4 percent slopes. This soil is in irregularly shaped, convex areas that range from about 3 to 320 acres in size.

Included with this soil in mapping are small areas of St. Clair soils on slightly higher rises or on the tops of knolls, areas of Hoytville soils in natural drainageways and small depressions, and small areas of Selfridge soils on rises or knolls. Also included are small scattered

areas of soils that have a surface layer of silty clay loam or clay loam. Areas of soils where slope is greater than 4 percent and small areas of wet soils are identified by spot symbols on the soil map.

The main concerns of management are removing excess water, controlling soil erosion, and maintaining organic-matter content and tilth.

This soil is suited to crops commonly grown in the county. Most areas are cropped. Some areas are idle, wooded, or in nonfarm uses. Capability unit IIIw-1 (1b); woody plant group 2.

Oakville Series

The Oakville series consists of well drained or moderately well drained, nearly level to gently sloping soils on outwash plains, lake plains, moraines, and beach ridges. These soils formed in sandy material.

In a representative profile, the surface layer is brown fine sand 4 inches thick. The upper 10 inches of the subsoil is yellowish brown, loose fine sand. The lower 16 inches is light yellowish brown, loose fine sand. The underlying material, at a depth of 30 inches, is light yellowish brown fine sand.

Permeability is very rapid. The available water capacity is low. Runoff is very slow or slow.

Oakville soils are poorly suited to crops commonly grown in the county. They are suited to woodland. Many areas are wooded or idle. Some areas are cultivated and others are in nonfarm uses.

Representative profile of Oakville fine sand, 0 to 6 percent slopes, in an idle field, 351 feet west and 219 feet north of the southeast corner of sec. 30, T. 4 S., R. 8 E.

Ap—0 to 4 inches, brown (10YR 4/3) fine sand; weak, fine, granular structure; very friable; many fine roots; medium acid; abrupt, smooth boundary.

B2—4 to 14 inches, yellowish brown (10YR 5/6) fine sand; single grained; loose; few fine roots; medium acid; clear, wavy boundary.

B3—14 to 30 inches, light yellowish brown (10YR 6/4) fine sand; few, fine, faint, brownish yellow (10YR 6/6) mottles; single grained; loose; few fine roots; slightly acid; clear, wavy boundary.

C—30 to 60 inches, light yellowish brown (10YR 6/4) fine sand; single grained; loose; slightly acid.

Thickness of the solum is typically 20 to 36 inches, but ranges from 18 to 40 inches. Depth to effervescent soil material ranges from 30 to more than 60 inches. Reaction is typically medium acid to neutral.

The Ap horizon is very dark grayish brown (10YR 3/2), brown (10YR 4/3), or dark grayish brown (10YR 4/2).

The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. The B3 horizon is yellowish brown (10YR 5/4, 5/6) or light yellowish brown (10YR 6/4).

The C horizon is brown (10YR 5/3), light yellowish brown (10YR 6/4), or pale brown (10YR 6/3). It is medium acid to mildly alkaline. In some pedons it is mildly alkaline and has slight effervescence.

Oakville soils in most landscapes are near Metea, Granby, Spinks, Tedrow, and Thetford soils. They lack the underlying loamy material characteristic of Metea soils. Unlike Granby soils, they lack the gray color and have a browner surface layer. They lack the bands in the B horizon characteristic of Spinks and Thetford soils and the gray mottles in the B horizon characteristic of Tedrow and Thetford soils.

OaB—Oakville fine sand, 0 to 6 percent slopes. This soil is in irregularly shaped or long, convex areas that range from about 2 to 160 acres in size.

Included with this soil in mapping are small areas of Tedrow or Tedrow, loamy substratum, soils on the lower toe slopes of rises or knolls. Also included are small areas of well drained soils that are similar to Oakville soils but have a few thin bands of loamy sand or sandy loam in the subsoil or substratum. Some scattered areas of soils where slope is greater than 6 percent, small areas of wet soils, and excavated areas are identified by spot symbols on the soil map.

The main concerns of management are controlling soil blowing, conserving moisture in midsummer, and maintaining organic-matter content.

This soil is poorly suited to crops commonly grown in the county. Many areas are used as a source of sand or are idle or wooded. Some areas are cropped or used as building sites. Capability unit IVs-1 (5a); woody plant group 3.

Owosso Series

The Owosso series consists of well drained, gently sloping to sloping soils on till plains, lake plains, and moraines. These soils formed in 24 to 40 inches of sandy and loamy material and the underlying loamy material.

In a representative profile, the surface layer is dark grayish brown sandy loam 9 inches thick. The subsurface layer is yellowish brown sandy loam 16 inches thick. The subsoil, 15 inches thick, is dark yellowish brown, friable sandy loam and firm silty clay loam mottled with brown or grayish brown. The underlying material, at a depth of 40 inches, is yellowish brown silty clay loam mottled with brown and grayish brown.

Permeability is moderately rapid in the sandy and loamy upper part of the subsoil and moderately slow in the lower part and underlying material. The available water capacity is high. Runoff is slow.

Owosso soils are well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated. The rest is idle or wooded.

Representative profile of Owosso sandy loam in an area of Owosso-Morley complex, 2 to 6 percent slopes, in an idle field, 51 feet south and 210 feet east of the northwest corner of sec. 31, T. 1 S., R. 8 E.

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; moderate, medium, granular structure; friable; many fine roots; 5 percent pebbles and cobblestones; medium acid; abrupt, smooth boundary.

A2—9 to 25 inches, yellowish brown (10YR 5/4) sandy loam; common, medium, faint, dark yellowish brown (10YR 3/4) mottles; moderate, medium, granular structure; friable; few fine roots; 5 percent pebbles and cobblestones; medium acid; clear, wavy boundary.

B1—25 to 31 inches, dark yellowish brown (10YR 4/4) sandy loam; few, medium, faint, yellowish brown (10YR 5/4) mottles; strong, coarse, subangular blocky structure; friable; 5 percent pebbles and cobblestones; slightly acid; clear, wavy boundary.

B21t—31 to 38 inches, dark yellowish brown (10YR 4/4) sandy loam; few, fine, faint, brown (10YR 5/3) mottles; moderate, medium, subangular blocky structure; friable; dark gray (10YR 4/1) worm casts; few, thin clay bridges between sand grains; 5 percent pebbles and cobblestones; slightly acid; abrupt, wavy boundary.

IIB22t—38 to 40 inches, yellowish brown (10YR 5/6) silty clay loam; common, fine, distinct, grayish brown (10YR 5/2) mottles; moderate, medium, angular blocky structure; firm; many, thick, grayish brown (10YR 5/2) clay films on surfaces of peds; 5 percent pebbles and cobblestones; neutral; abrupt, wavy boundary.

IIC—40 to 60 inches, yellowish brown (10YR 5/6) silty clay loam; common, medium, distinct, brown (10YR 5/3) and grayish brown (10YR 5/2) mottles; massive; firm; very pale brown (10YR 7/3) lime streaks; slight effervescence; mildly alkaline.

Thickness of the solum ranges from 24 to 45 inches and corresponds to the depth to effervescent material. Depth to the IIB horizon is 20 to 38 inches. Reaction ranges from medium acid to neutral in the upper 38 inches and neutral to mildly alkaline below.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3). The content of pebbles and cobblestones is 1 to 10 percent. The A2 horizon is yellowish brown (10YR 5/4) or brown (10YR 5/3) sandy loam, fine sandy loam, or loamy sand. It does not occur in all pedons. The content of pebbles and cobblestones is 1 to 15 percent.

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 8. It is sandy loam, fine sandy loam, gravelly sandy loam, or loamy fine sand. The content of pebbles and cobblestones is 1 to 20 percent. The IIB horizon is dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/6) clay loam, silty clay loam, or heavy loam. The content of pebbles and cobblestones is 5 to 10 percent.

The IIC horizon has hue of 10YR, value of 5 or 6, and chroma of 3, 4, or 6. It is loam, silt loam, or silty clay loam. The content of pebbles and cobblestones is 2 to 5 percent.

Owosso soils in most landscapes are near Morley and Metamora soils. Unlike Morley soils, they have sandy loam material 20 to 40 inches thick underlain by a finer textured C horizon. They lack the gray and grayish brown matrix colors in the solum that are characteristic of Metamora soils.

OwB—Owosso-Morley complex, 2 to 6 percent slopes. This mapping unit is in broad to narrow, irregularly shaped, convex areas on till plains, lake plains, and moraines. It is about 60 percent Owosso sandy loam, 20 percent Morley loam, and 20 percent minor soils. These Owosso and Morley soils have the profiles described as representative of their respective series. Morley loam is typically on the slightly higher convex slopes. Areas range from about 5 to 50 acres in size.

Included with this unit in mapping are small areas of Blount and Metamora soils in slight depressions and drainageways. Also included are small areas of soils that have slightly effervescent, mildly alkaline underlying material at a depth of 15 to 20 inches and a few areas of soils where slope is less than 2 percent. Scattered areas of soils where slope is greater than 6 percent and small areas of wetter soils are identified by spot symbols on the soil map.

Soil blowing is a hazard on Owosso sandy loam. The main concerns of management are controlling soil blowing and soil erosion and maintaining organic-matter content.

This mapping unit is suited to crops commonly grown in the county. It is also suited to orchards. Many areas are cropped. Some areas are idle or wooded. Capability unit IIe–1 (3/2a, 1.5a) ; woody plant group 4.

OwC—Owosso-Morley complex, 6 to 12 percent slopes. This mapping unit is in narrow, long and irregularly shaped, convex areas on till plains, lake plains, and moraines. It is about 60 percent Owosso sandy loam, 20 percent Morley loam, and 20 percent minor soils. These Owosso and Morley soils have profiles similar to those described as representative of their respective series, but the subsoil is thinner. Part of the subsoil has been mixed with the surface layer. Morley loam is typically on the slightly higher convex slopes. Areas range from about 5 to 20 acres in size.

Included with this unit in mapping are small areas of Metamora and Blount soils in small depressions or in drainageways. Also included are areas of soils on the tops of hills where slope is less than 6 percent, small areas of eroded soils, and small areas of soils that have slightly effervescent, mildly alkaline underlying material at a depth of 15 to 20 inches. Small areas of soils where slope is greater than 12 percent and small areas of wetter soils are identified by spot symbols on the soil map.

The main concerns of management are controlling soil erosion and soil blowing and maintaining organic-matter content and tilth.

This mapping unit is suited to crops commonly grown in the county. It is also suited to orchards. Most areas are cropped. Some are idle or wooded. A few areas are in wildlife habitat or nonfarm uses. Capability unit IIIe–3 (3/2a, 1.5a) ; woody plant group 4.

Pella Series

The Pella series consists of poorly drained, nearly level soils on outwash plains, lake plains, and deltas. These soils formed mainly in waterlain, stratified loamy deposits.

In a representative profile, the surface layer is black silt loam 10 inches thick. The subsurface layer, 6 inches thick, is black silt loam mottled with yellowish brown. The subsoil, 10 inches thick, is dark gray, friable heavy silt loam mottled with grayish brown and yellowish brown. The underlying material, at a depth of 26 inches, is grayish brown, stratified silty clay loam and silt mottled with yellowish brown. At a depth of 35 inches, it is yellowish brown, stratified silty clay loam, silt, and silt loam mottled with gray.

Permeability is moderate. The available water capacity is very high. Runoff is very slow, or ponded.

Pella soils are suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are idle. The rest is cultivated, wooded, or in nonfarm uses.

Representative profile of Pella silt loam, in a hayfield, 216 feet west and 710 feet north of the southeast corner of SW1/4 sec. 23, T. 4 S., R. 9 E.

Ap—0 to 10 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; friable; many fine roots; mildly alkaline; abrupt, smooth boundary.

A12—10 to 16 inches, black (10YR 2/1) silt loam; common, medium, distinct, yellowish brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; common fine roots; mildly alkaline; clear, wavy boundary.

B2g—16 to 26 inches, dark gray (10YR 4/1) heavy silt loam; common, medium, distinct, grayish brown (10YR 5/2) mottles and common, fine, distinct, yellowish brown (10YR 5/6) mottles; moderate, medium, angular blocky structure; friable; few fine roots; mildly alkaline; abrupt, wavy boundary.

C1g—26 to 35 inches, grayish brown (10YR 5/2), stratified silty clay loam and silt; common, medium, distinct, yellowish brown (10YR 5/6) mottles; moderate, thick, platy structure; friable; gray (10YR 6/2) silt coatings

on horizontal, platy ped faces; few fine roots; slight effervescence; mildly alkaline; clear, wavy boundary.

C2—35 to 60 inches, yellowish brown (10YR 5/4) stratified silty clay loam, silt, and silt loam; common, medium, distinct, gray (10YR 5/1) mottles; massive; friable; slight effervescence; mildly alkaline.

Thickness of the solum is typically 24 to 36 inches, but ranges from 24 to 45 inches. Depth to effervescent material corresponds to the depth of the solum. Reaction ranges from slightly acid to mildly alkaline in the Ap horizon and neutral to mildly alkaline throughout the rest of the solum.

The Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The A12 horizon is black (10YR 2/1) or very dark gray (10YR 3/1) silt loam or heavy silt loam. It does not occur in all pedons.

The B horizon is dark gray (10YR 4/1), gray (10YR 5/1), light gray (10YR 6/1), grayish brown (10YR 5/2), or dark grayish brown (10YR 4/2) silty clay loam or silt loam. It contains strata of silt, fine sand, loamy very fine sand, fine sandy loam, and silty clay. Thickness of the strata ranges from 1/4 inch to about 16 inches. Thickness and vertical sequence of the strata vary within short horizontal distances.

The C horizon is light gray (10YR 6/1), gray (10YR 5/1), or grayish brown (10YR 5/2 or 2.5Y 5/2), and yellowish brown (10YR 5/4). It is typically stratified silt, silt loam, and silty clay loam, but strata of clay, fine sand, and very fine sand are common. Thickness of the strata ranges from 1/4 inch to 5 inches. The C horizon is mildly or moderately alkaline and has slight to strong effervescence.

Pella soils in most landscapes are near Belleville, Kibbie, and Selfridge soils. Unlike Belleville and Selfridge soils, Pella soils have a finer textured solum and a stratified C horizon. They are grayer in the B horizon than Kibbie soils.

Pc—Pella silt loam. This soil is in irregularly shaped, low, flat areas that range from about 5 to 50 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Kibbie soils on slightly higher rises near till plains and small areas of Pewamo and Belleville soils. Also included are small areas of wetter soils in depressions that have effervescent material at a depth of 12 to 24 inches and small areas of soils that have a surface layer of loamy fine sand. Small areas of marshy soils and soils that have a mucky surface layer are identified by spot symbols on the soil map.

Wetness is a limitation. Some low depressional areas and areas along streams and drainageways are subject to flooding. The main concern of management is removing excess water.

This soil is suited to crops commonly grown in the county. Many areas are idle. Some areas are cropped. The rest is wooded or in nonfarm uses. Capability unit IIw-3 (2.5c); woody plant group 5.

Pewamo Series

The Pewamo series consists of poorly drained or very poorly drained, nearly level or gently sloping soils on till plains, lake plains, and moraines. These soils formed in loamy and clayey glacial till.

In a representative profile, the surface layer is very dark gray loam 10 inches thick. The subsoil is 8 inches of dark gray silty clay loam; 9 inches of gray, firm silty clay loam mottled with yellowish brown; and 9 inches of gray, firm heavy silty clay loam mottled with strong brown. The underlying material, at a depth of 36 inches, is yellowish brown silty clay loam mottled with gray and brown.

Permeability is moderately slow. The available water capacity is high. Runoff is very slow.

Pewamo soils are suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated. The rest is wooded, idle, or in nonfarm uses.

Representative profile of Pewamo loam, in an idle field, 250 feet west and 1,300 feet north of the southeast corner of NE1/4 sec. 28, T. 4 S., R. 9 E.

Ap—0 to 10 inches, very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate, medium, granular structure; friable; many fine roots; 1 percent pebbles; slightly acid; abrupt, smooth boundary.

B21tg—10 to 18 inches, dark gray (10YR 4/1) silty clay loam; common, medium, faint, dark yellowish brown (10YR 4/4) mottles; moderate, medium, prismatic structure parting to moderate, medium, angular blocky; friable; few, thin, dark gray (10YR 2/1) clay films on vertical surfaces of peds; black (10YR 2/1) krotovinas; common fine roots; 1 percent pebbles; slightly acid; gradual wavy boundary.

B22tg—18 to 27 inches, gray (10YR 5/1) silty clay loam; common, medium, distinct, yellowish brown (10YR 5/6) and common, medium, faint, gray (10YR 4/1) mottles; moderate, medium, prismatic structure parting to moderate, medium, angular blocky; firm; many, thin, gray (10YR 5/1) clay films on surfaces of peds; black (10YR 2/1) krotovinas; few fine roots; 1 percent pebbles; neutral; gradual, wavy boundary.

B23tg—27 to 36 inches, gray (10YR 5/1), heavy silty clay loam; common, medium, distinct, strong brown (7.5YR 5/6) mottles; strong, coarse, prismatic structure parting to moderate, medium, angular blocky; firm; continuous, thick, gray (10YR 5/1) clay films on surfaces of peds; very dark gray (10YR 3/1) krotovinas; few fine roots; 2 percent pebbles; neutral; abrupt, wavy boundary.

C—36 to 60 inches, yellowish brown (10YR 5/6) silty clay loam; common, medium, distinct, gray (10YR 5/1) and brown (7.5YR 5/2) mottles; strong, coarse, prismatic structure parting to strong, medium, angular blocky; firm; few, thin, gray (10YR 5/1) clay films on vertical surfaces of peds; very dark grayish brown (10YR 3/2) krotovinas; pale brown (10YR 6/3) and light gray (10YR 7/2) lime steaks; few fine roots; 2 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum is typically 33 to 40 inches, but ranges from 28 to 45 inches. Depth to effervescent material corresponds to the depth of the solum. Reaction ranges from slightly acid to neutral in the A horizon and slightly acid to mildly alkaline throughout the rest of the solum. The content of pebbles and cobblestones throughout the solum is 1 to 5 percent.

The Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2).

The B horizon is dark gray (10YR 4/1), gray (10YR 5/1, 5Y 5/1), light gray (10YR 6/1), or grayish brown (10YR 5/2) clay loam, silty clay loam, silty clay, or clay. Very dark brown (10YR 2/2) concretions are in some pedons.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 6. It is clay loam or silty clay loam. The content of pebbles and cobblestones is 1 to 5 percent. It is mildly alkaline and has slight to strong effervescence.

Pewamo soils in most landscapes are near Blount, Morley, Corunna, Hoytville, and Selfridge soils. Pewamo soils are grayer in the B horizon than Blount and Morley soils and are finer textured in the solum than Corunna soils. They are coarser textured in corresponding horizons than Hoytville soils and finer textured in the B horizon than Selfridge soils.

Pe—Pewamo loam. This soil is in irregularly shaped, low, flat areas that range from 5 to 400 acres in size. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas

of Blount, Corunna, and Metamora soils on slightly higher rises and knolls. Also included are small areas of soils that have a surface layer of clay loam or silty clay loam. Marshy soils and small areas of soils that have a shallow, mucky surface are identified by spot symbols on the soil map.

Wetness is a limitation. Some low depressional areas and areas along streams and drainageways are subject to flooding. The main concerns of management are removing excess water and maintaining tilth.

This soil is suited to crops commonly grown in the county. Most areas are cropped. Some areas are idle, wooded, or in nonfarm uses. Capability unit IIw-1 (1.5c); woody plant group 5.

Selfridge Series

The Selfridge series consists of somewhat poorly drained, nearly level to gently sloping soils on lake plains and till plains. These soils formed in 20 to 40 inches of sandy and loamy material and the underlying loamy material.

In a representative profile, the surface layer is very dark grayish brown loamy sand 9 inches thick. The subsurface layer is pale brown, loose sand 9 inches thick. The upper 6 inches of the subsoil is yellowish brown, very friable loamy sand. The lower 7 inches is yellowish brown, friable sandy loam and brown, firm clay loam mottled with grayish brown and gray. The underlying material, at a depth of 31 inches, is grayish brown clay loam mottled with light gray and yellowish brown.

Permeability is rapid in the sandy material and upper loamy material and moderately slow in the lower loamy material. The available water capacity is moderate. Runoff is very slow.

Selfridge soils are moderately well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated, and in some areas specialty crops are grown. The rest is wooded or pastured, in nonfarm uses, or idle.

Representative profile of Selfridge loamy sand, 0 to 3 percent slopes, in a cultivated field, 720 feet north and 800 feet east of the southwest corner of SW1/4 sec. 20, T. 4 S., R. 9 E.

Ap—0 to 9 inches, very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak, fine, granular structure; very friable; many fine roots; 1 percent pebbles; slightly acid; abrupt, smooth boundary.

A2—9 to 18 inches, pale brown (10YR 6/3) sand; common, fine, faint, grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; single grained; loose; few fine roots; 1 percent pebbles; slightly acid; clear, wavy boundary.

B1—18 to 24 inches, yellowish brown (10YR 5/6) loamy sand; common, fine, faint, brown (10YR 5/3) and grayish brown (10YR 5/2) mottles; weak, fine, granular structure; very friable; few fine roots; 1 percent pebbles; neutral; abrupt, wavy boundary.

B21t—24 to 29 inches, yellowish brown (10YR 5/6) sandy loam; common, fine, distinct, grayish brown (10YR 5/2) mottles; weak, coarse, subangular blocky structure; friable; few, thin clay bridges between sand grains; 1 percent pebbles; neutral; abrupt, wavy boundary.

IIB22t—29 to 31 inches, brown (7.5YR 5/4) clay loam; many, fine, distinct, gray (10YR 5/1) mottles; weak, coarse, angular blocky structure; firm; continuous, thin grayish brown (10YR 5/2) clay films on surfaces of peds; 2 percent pebbles; mildly alkaline; clear, wavy boundary.

IICg—31 to 60 inches, grayish brown (10YR 5/2) clay loam; many, fine, distinct, light gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; massive; firm; 3 percent pebbles; strong effervescence; mildly alkaline.

Thickness of the solum is typically 24 to 34 inches, but ranges from 24 to 40 inches. Depth to effervescent material corresponds to the depth of the solum. Reaction ranges from medium acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part. The content of pebbles throughout the solum is less than 5 percent.

The Ap horizon is very dark gray (10YR 3/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The A2 horizon is yellowish brown (10YR 5/4, 5/6), light brownish yellow (10YR 6/4), pale brown (10YR 6/3), or dark brown (10YR 4/3) fine sand, sand, loamy sand, or loamy fine sand.

The B1 horizon is yellowish brown (10YR 5/4, 5/6), light olive brown (2.5Y 5/4), light yellowish brown (10YR 6/4), brown (10YR 5/3), or pale brown (10YR 6/3) sand, fine sand, loamy sand, or loamy fine sand. The B21t horizon is yellowish brown (10YR 5/4, 5/6), light yellowish brown (10YR 6/4), dark brown (10YR 3/3), or grayish brown (10YR 5/2) loamy sand, loamy fine sand, sandy loam, fine sandy loam, or clay loam. The IIB22t horizon is brown (7.5YR 5/4), yellowish brown (10YR 5/4, 5/6), light brownish gray (10YR 6/2), grayish brown (10YR 5/2), or yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) loam, sandy loam, clay loam, or silty clay loam.

The IICg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 through 6. It is clay loam or silty clay loam. In some pedons this horizon contains varves of silt, silt loam, and very fine sand. Pebbles in the IICg horizon range from 1 to 5 percent. The horizon is mildly alkaline and is slightly or strongly effervescent.

Selfridge soils in most landscapes are near Belleville, Corunna, Kibbie, Metea, Pella, and Pewamo soils. They are mapped with Pewamo and Metea soils. They are browner in the subsoil than Belleville and Corunna soils. They lack the stratification in the C horizon that is characteristic of Pella and Kibbie soils, and they have a coarser textured solum Unlike Pewamo soils, Selfridge soils lack the gray color in the solum and are coarser textured in the solum. They have grayer mottles than Metea soils.

Se—Selfridge loamy sand, 0 to 3 percent slopes. This soil is in irregularly shaped, convex areas that range from about 5 to 120 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Tedrow soils on slightly higher rises or knolls where the slope is 3 or 4 percent and small areas of Metea soils on the more sloping rises or knolls. Also included are small areas of Belleville soils in natural drainageways and depressions, small depressions of Pewamo and Hoytville soils, and small areas where the surface layer is sandy loam or fine sandy loam. Short slopes greater than 3 percent along drainageways, small areas of wetter soils, and excavated areas are identified by spot symbols on the soil map.

Droughtiness is a hazard in drained areas. The main concerns of management are removing excess water, controlling soil blowing, conserving moisture in midsummer, and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops if drained and irrigated. Most areas are cropped. In some areas specialty crops and sod are grown. The rest is idle, wooded or pastured, or in nonfarm uses. Capability unit IIIw-4 (4/2b); woody plant group 2.

SfA—Selfridge-Pewamo complex, 0 to 2 percent slopes. This mapping unit is on broad lake plains. It is about 50 percent Selfridge loamy sand, 30 percent Pewamo loam, and 20 percent minor soils. Selfridge loamy sand is on slightly raised knolls and ridges. Pewamo loam is in oblong depressions and other areas ½ foot to 3 feet lower than the adjacent areas of Selfridge loamy sand. Areas range from about 10 to 200 acres in size.

Included with this unit in mapping are small areas of Blount and Metea soils on the slightly higher rises or knolls and small areas of Corunna soils in depressions. Excavated areas are identified by spot symbols on the soil map.

Soil blowing and droughtiness are limitations on Selfridge loamy sand. Wetness and poor tilth are limitations on Pewamo loam. Some low depressional areas are subject to flooding by runoff from adjacent areas. The main concerns of management are removing excess water, controlling soil blowing, conserving moisture in midsummer, and maintaining organic-matter content and tilth.

This mapping unit is suited to crops commonly grown in the county. Most areas are cropped. Some are idle, some are wooded, and some are under urban development. Capability unit IIIw-4 (1.5c, 4/2b) ; woody plant group 2.

SgB—Selfridge-Pewamo-Metea complex, 0 to 4 percent slopes. This mapping unit is on broad plains. It is 40 percent Selfridge loamy sand, 25 percent Pewamo loam, 15 percent Metea loamy sand, and 20 percent minor soils. The nearly level Selfridge loamy sand is on slightly raised sand knolls and ridges. Pewamo loam is in oblong depressions and other areas ½ foot to 4 feet lower than the adjacent areas of Selfridge and Metea loamy sand. Metea loamy sand is on the higher knolls and ridges. Areas commonly range from about 10 to 500 acres in size.

Included with this unit in mapping are small areas of Tedrow soils on some of the higher sandy rises. Also included are small areas of Blount soils at slightly higher positions and small areas of Corunna soils in depressions.

Soil blowing and droughtiness are hazards on Metea loamy sand and Selfridge loamy sand. Wetness and poor tilth are limitations on Pewamo loam. Some low depressional areas are subject to flooding by runoff from adjacent areas. The main concerns of management are removing excess water, controlling soil blowing, conserving moisture in midsummer, and maintaining organic-matter content and tilth.

This mapping unit is suited to crops commonly grown in the county. Most areas are cropped. Some are idle, some are in orchards, and others are pastured. Capability unit IIIw-4 (4/2b, 4/2a, 1. 5c) ; woody plant group 2.

Shoals Series

The Shoals series consists of somewhat poorly drained, nearly level soils on flood plains. These soils formed mainly in loamy alluvium.

In a representative profile, the surface layer is dark grayish brown silt loam 9 inches thick. The subsoil is 7 inches of dark brown, friable silt loam mottled with brown; 12 inches of dark brown, friable heavy silt loam mottled with grayish brown; and 12 inches of grayish brown, firm silty clay loam mottled with yellowish brown. The underlying material, at a depth of 40 inches, is yellowish brown silty clay loam mottled with grayish brown. At a depth of 55 inches, it is grayish brown loam mottled with yellowish brown.

Permeability is moderate. The available water capacity is high. Runoff is slow.

Shoals soils are moderately well suited to crops commonly grown in the county. They are suited to woodland and to wildlife habitat and intermittent pasture. In many areas these soils are idle or in nonfarm uses. The rest is wooded or cropped.

Representative profile of Shoals silt loam, in a field of thornapple, grasses, and weeds, 885 feet west and 345 feet north of the southeast corner of SW1/4 sec. 30, T. 2 S., R. 9 E.

Ap—0 to 9 inches, dark grayish brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many fine roots; neutral; abrupt, smooth boundary.

B1—9 to 16 inches, dark brown (10YR 4/3) silt loam; common, medium, distinct, brown (10YR 5/3) mottles; moderate, medium, angular blocky structure; friable; dark grayish brown (10YR 4/2) root channels; many fine roots; neutral; clear, wavy boundary.

B2—16 to 28 inches, dark brown (10YR 4/3), heavy silt loam; few fine, distinct, grayish brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; friable; common fine roots; mildly alkaline; gradual, wavy boundary.

B3—28 to 40 inches, grayish brown (10YR 5/2) silty clay loam; common, fine, distinct, yellowish brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; few fine roots; mildly alkaline; gradual, wavy boundary.

C1—40 to 55 inches, yellowish brown (10YR 5/6) silty clay loam; common, medium, distinct, grayish brown (10YR 5/2) mottles; massive; firm; mildly alkaline; gradual, wavy boundary.

C2—55 to 60 inches, grayish brown (10YR 5/2) loam; common, medium, distinct, yellowish brown (10YR 5/4) mottles; massive; friable; 5 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum is 24 to 40 inches. Depth to calcareous material is 20 to 55 inches. Reaction is neutral to mildly alkaline.

The Ap horizon is silt loam or loam.

The B1 horizon is dark brown (10YR 4/3), dark grayish brown (10YR 4/2), or yellowish brown (10YR 5/4) silt loam, fine sandy loam, or sandy loam. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is loam, silt loam, silty clay loam, very fine sandy loam, or sandy loam. The B3 horizon is dark yellowish brown (10YR 3/4), pale brown (10YR 6/3), yellowish brown (10YR 5/4), or grayish brown (10YR 5/2) sandy loam, silt loam, fine sandy loam, or silty clay loam.

The C horizon is yellowish brown (10YR 5/4), brown (10YR 5/3), grayish brown (10YR 5/2), or pale brown (10YR 6/3) sandy loam, fine sandy loam, loam, silt loam, very fine sandy loam, silty clay loam, gravelly sandy loam, or sand. It is mildly alkaline to alkaline and has strong effervescence.

This soil does not have the gray colors that are typical of the series, but this fact does not affect its use and management.

Shoals soils in most landscapes are near Sloan and Cohoctah soils. They are less gray in the B horizon than Sloan soils and are not so coarse textured as Cohoctah soils.

ShB—Shoals silt loam. This soil is on long, narrow, slightly raised flood plains along rivers and streams. Areas range in size from 10 to 80 acres. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Sloan and Cohoctah soils in lower depressional areas. Also included are small areas of moderately well drained soils on higher terraces and small areas of soils that are slightly effervescent and mildly alkaline at or near the surface.

Flooding is the main hazard. The main concerns of management are removing excess water and protecting the soil from the floodwater.

This soil, if drained, is suited to crops commonly grown in the county. Flooding usually occurs early in spring and lasts for a few days. Crops may be flooded late in fall in some years. This soil is also suited to recreational and park uses. Many areas are used for parks and recreation. Some are idle. Other areas are wooded or cropped. Capability unit IIw-3 (L–2c); woody plant group 2.

Sloan Series

The Sloan series consists of very poorly drained, nearly level soils on bottom land along streams and rivers. These soils formed in loamy and sandy alluvium.

In a representative profile, the surface layer is very dark gray silt loam 7 inches thick. The subsurface is very dark gray silt loam 13 inches thick. The upper 20 inches of the subsoil is dark grayish brown, friable light silty clay loam mottled with yellowish brown. The lower 15 inches is grayish brown, firm light silty clay loam mottled with yellowish brown. The underlying material, at a depth of 55 inches, is grayish brown sandy loam mottled with yellowish brown.

Permeability is moderate. The available water capacity is high. Runoff is very slow or ponded.

Sloan soils are not suited to crops commonly grown in the county because they are wet and subject to flooding (fig. 14). They are suited to woodland. In many areas these soils are idle. Some areas provide wildlife habitat, parks, or picnic grounds. A few areas are cultivated.

Figure 14.—**Flooding on Sloan soils along the Huron River.**

Representative profile of Sloan silt loam, undrained, in a wooded area, 126 feet east and 300 feet north of the southwest corner of sec. 25, T. 2 S., R. 8 E.

A1—0 to 7 inches, very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate, medium, granular structure; friable; many fine roots; mildly alkaline; clear, wavy boundary.

A12—7 to 20 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; few fine roots; mildly alkaline; clear, wavy boundary.

B2g—20 to 40 inches, dark grayish brown (10YR 4/2) light silty clay loam; common, medium, distinct, yellowish brown (10YR 5/4) mottles; moderate, medium, granular structure; friable; few fine roots; mildly alkaline; abrupt, wavy boundary.

B3g—40 to 55 inches, grayish brown (10YR 5/2), light silty clay loam; common, medium, distinct, yellowish brown (10YR 5/6) mottles; massive; firm; few fine roots; mildly alkaline; clear, wavy boundary.

IICg—55 to 60 inches, grayish brown (10YR 5/2) sandy loam; common, medium, distinct, yellowish brown (10YR 5/6) mottles; massive; friable; neutral.

Thickness of the solum is 20 to 55 inches. Reaction ranges from neutral to mildly alkaline in the upper part and slightly acid to mildly alkaline in the lower part. The content of pebbles and cobblestones is less than 5 percent in some profiles.

The Ap, A1, and A12 horizons are black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1) silt loam or loam.

The B horizon is dark gray (10YR 4/1), dark grayish brown (10YR 4/2), gray (10YR 5/1), grayish brown (10YR 5/2), or olive gray (5Y 5/2, 4/2) silty clay loam, clay loam, silt loam, or loam.

The IIC horizon is dark gray (10YR 4/1), gray (10YR 5/1), grayish brown (10YR 5/2), or dark gray (N 4/0) stratified loamy fine sand, sandy loam, silt loam, silty clay loam, or sand and gravel. Very dark brown (10YR 2/2) organic stains are in places.

Sloan soils in most landscapes are near Shoals and Cohoctah soils. They are grayer in the B horizon than Shoals soils and finer textured throughout the profile than Cohoctah soils.

So—Sloan silt loam, wet. This soil is in broad to narrow, elongated areas on flood plains. Areas range from 10 to 80 acres in size. Slope are 0 to 2 percent.

Included with this soil in mapping are small areas of Cohoctah soils, frequently flooded, and Shoals soils on slight rises and higher knolls and ridges. Also included are many small areas of soils that are slightly effervescent at the surface or within 20 inches of the surface and areas of soils where slope is greater than 2 percent.

Wetness is a limitation and flooding is the main hazard. Some low depressional areas are subject to ponding. The main concerns of management are removing excess water and protecting the soil from floodwater.

This soil is suited to crops commonly grown in the county if drainage and flood protection are provided. It is also suited to recreational and park uses. Most areas are idle or wooded. Some areas are used for parks and recreation, and few areas are cropped. Capability unit Vw-1 (L-2c); woody plant group 5.

Spinks Series

The Spinks series consists of well drained, nearly level to sloping soils on moraines, till plains, outwash plains, and beach ridges on lake plains. These soils formed in sandy material.

In a representative profile, the surface layer is dark brown loamy sand 10 inches thick. The upper 8 inches of the subsoil is brownish yellow, loose fine sand. The lower 37 inches is pale brown, loose fine sand that has several ½ to 2-inch bands of dark brown, massive loamy fine sand. The underlying material, at a depth of 55 inches, is pale brown fine sand.

Permeability is rapid. The available water capacity is low. The organic-matter content is very low or low. Runoff is very slow or slow.

Spinks soils are moderately well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are idle or wooded. The rest is cultivated, pastured, or in nonfarm uses.

Representative profile of Spinks loamy sand, 0 to 6 percent slopes, in a cultivated field; 801 feet west and 138 feet north of the southeast corner of SW1/4, sec. 28, T. 1 S., R. 8 E.

Ap—0 to 10 inches, dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak, medium, granular structure; very friable; many fine roots; neutral; abrupt, smooth boundary.

B1—10 to 18 inches, brownish yellow (10YR 6/6) fine sand; single grained; loose; few fine roots; neutral; clear, wavy boundary.

A2&Bt—18 to 55 inches, pale brown (10YR 6/3) fine sand (A2); single grained; loose; and dark brown (7.5YR 4/4) loamy fine sand (Bt); massive; friable; few, thin clay bridges between sand grains; mildly alkaline; abrupt, wavy boundary.

C—55 to 60 inches, pale brown (10YR 6/3) fine sand; single grained; loose; mildly alkaline.

Thickness of the solum is 36 to 60 inches. Reaction is medium acid to neutral in the upper part and neutral to mildly alkaline in the lower part. The content of pebbles and cobblestones throughout the solum is 0 to 5 percent.

The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 3/3 and 10YR 4/3).

The B1 horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is fine sand, sand, or loamy sand. The A2&Bt horizon is described by the characteristics of each part. The A2 horizon is pale brown (10YR 6/3) or yellowish brown (10YR 5/4, 5/6) fine sand, sand, or loamy sand. It is single grained or has weak, medium, granular structure. The Bt bands are dark yellowish brown (10YR 4/4), dark brown (7.5YR 4/4), or yellowish brown (10YR 5/6) loamy fine sand, loamy sand, sand, or sandy loam. Thickness of the Bt bands ranges from 1/8 inch to about 5 inches. The cumulative thickness of the Bt bands is more than 6 inches. Bands are typically discontinuous.

The C horizon is brown (10YR 5/3), pale brown (10YR 6/3), or yellowish brown (10YR 5/4) fine sand or sand. Reaction ranges from neutral to mildly alkaline. The content of pebbles and cobblestones is 0 to 5 percent.

Spinks soils in most landscapes are near Boyer, Oakville, and Thetford soils. Unlike Boyer soils, they do not have a IIC horizon of gravelly sand. Unlike Boyer and Oakville soils, they have a banded, thin Bt horizon. They lack the gray in the B horizon that is characteristic of Thetford soils.

SpB—Spinks loamy sand, 0 to 6 percent slopes. This soil is in irregularly shaped, convex areas that range from about 3 to 30 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Thetford soils in natural waterways and depressions and small areas of Oakville soils. Also included are small areas of soils that have underlying material of silty clay loam at a depth of 38 to 60 inches. Scattered areas of soils where slope is greater than 6 percent,

small areas of wet soils, and excavated areas are identified by spot symbols on the soil map.

The main concerns of management are controlling soil blowing, conserving moisture in midsummer, and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops if irrigated. Many areas are idle or wooded. Some areas are cropped, and a few areas are in nonfarm uses. Capability unit IIIs-1 (4a); woody plant group 3.

SpC—Spinks loamy sand, 6 to 12 percent slopes. This soil is in irregularly shaped, convex areas that range from 3 to 35 acres in size. It has a profile similar to that described as representative of the series, but the surface layer is brown and is thinner.

Included with this soil in mapping are small areas of Thetford soils in natural waterways and depressions and small areas of Oakville soils. Also included are small areas of soils that have underlying material of silty clay loam at a depth of 38 to 60 inches. Scattered areas of soils where slope is greater than 12 percent and small areas of wetter soils are identified by spot symbols on the soil map.

The main concerns of management are controlling water erosion and soil blowing, conserving moisture in midsummer, and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. Many areas are pastured or idle. A few areas are cropped, wooded, or in nonfarm uses. Capability unit IIIe-4 (4a); woody plant group 3.

St. Clair Series

The St. Clair series consists of well drained or moderately well drained, gently sloping to sloping soils on till plains and moraines. These soils formed in clayey glacial till.

In a representative profile, the surface layer is dark grayish brown clay loam 8 inches thick. The subsurface layer, 2 inches thick, is pale brown silty clay loam mottled with yellowish brown. The upper 7 inches of the subsoil is yellowish brown, firm clay. The lower 11 inches is dark brown, firm clay mottled with yellowish brown. The underlying material, at a depth of 28 inches, is dark brown clay mottled with yellowish brown.

Permeability is very slow. The available water capacity is moderate. Runoff is slow to medium in more sloping areas.

St. Clair soils are moderately well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are idle or wooded. The rest is cultivated or pastured.

Representative profile of St. Clair clay loam, 2 to 6 percent slopes, in a cultivated field, 1,905 feet west and 1,074 feet north of the southeast corner of sec. 30, T. 1 S., R. 8 E.

Ap—0 to 8 inches, dark grayish brown (10YR 4/2) clay loam; moderate, medium, granular structure; friable; common fine roots; 3 percent pebbles; slightly acid; abrupt, smooth boundary.

A2—8 to 10 inches, pale brown (10YR 6/3) silty clay loam; common, medium, distinct, yellowish brown (10YR 5/6) mottles; weak, medium, platy structure; friable; common fine roots; 3 percent pebbles; neutral; clear, wavy boundary.

B21t—10 to 17 inches, yellowish brown (10YR 5/4) clay; common, fine, faint, yellowish brown (10 YR 5/6) and common, medium, faint, brown (10YR 5/3) mottles; moderate, medium, angular blocky structure; firm; many, moderately thick, dark brown (10YR 4/3) clay films on surfaces of peds; few fine roots; 3 percent pebbles; neutral; clear, wavy boundary.

B22t—17 to 28 inches, dark brown (10YR 4/3) clay; common, medium, distinct, yellowish brown (10YR 5/6) mottles; moderate, medium, angular blocky structure; firm; many, moderately thick, dark brown (10YR 4/3) clay films on surfaces of peds; few fine roots; 3 percent pebbles; neutral; clear, wavy boundary.

C—28 to 60 inches, dark brown (10YR 4/3) clay; few, fine, faint, grayish brown (10YR 5/2) mottles and few, fine, distinct, yellowish brown (10YR 5/6) mottles; moderate, medium, angular blocky structure; firm; light gray (10YR 7/2) lime streaks; 3 percent pebbles; strong effervescence; mildly alkaline.

Thickness of the solum is 20 to 30 inches. Depth to effervescent material is 20 to 30 inches. Reaction ranges from slightly acid to neutral in the A horizon and neutral to mildly alkaline throughout the rest of the solum. The content of pebbles and cobblestones throughout the solum ranges from 0 to 5 percent.

The Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 5/3), dark brown (10YR 4/3), or very dark grayish brown (10YR 3/2).

The A2 horizon is pale brown (10YR 6/3), brown (10YR 5/3), or grayish brown (10YR 5/2) heavy silt loam, silty clay loam, or clay loam. It does not occur in all pedons.

The B2 horizon is dark brown (10YR 4/3, 7.5YR 4/4), yellowish brown (10YR 5/4), brown (7.5YR 5/4, 10YR 5/3), or dark yellowish brown (10YR 4/4) silty clay or clay.

The C horizon is yellowish brown (10YR 5/4), brown (10YR 5/3), dark brown (10YR 4/3), or dark yellowish brown (10YR 4/4) silty clay or clay. The content of pebbles and cobblestones is 1 to 5 percent.

St. Clair soils in most landscapes are near Hoytville, Morley, and Nappanee soils. They are browner in the B horizon than Hoytville soils and are finer textured in corresponding horizons than Morley soils. They lack the gray mottles in the upper part of the B horizon that are characteristic of Napanee soils.

StB—St. Clair clay loam, 2 to 6 percent slopes. This soil is in irregularly shaped, convex areas that range from about 3 to 40 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Nappanee soils on foot slopes or in natural waterways and small depressions and small areas of Owosso soils on the tops of rises or knolls. Also included are small areas of Morley soils and small areas of soils, on the tops of rises or knolls, that have slightly effervescent, mildly alkaline underlying material at a depth of 15 to 20 inches. Areas where slope is greater than 6 percent and small areas of wet soils are identified by spot symbols on the soil map.

The main concerns of management are controlling soil erosion and maintaining organic-matter content and tilth.

This soil is suited to crops commonly grown in the county. Many areas are idle or wooded. A few areas are cropped. Capability unit IIIe-1 (1a); woody plant group 2.

StC—St. Clair clay loam, 6 to 12 percent slopes. This soil is in irregularly shaped, convex areas that range from about 3 to 30 acres in size. This soil has a profile

similar to that described as representative of the series, but the surface layer is brown and is thinner.

Included with this soil in mapping are small areas of Nappanee soils on foot slopes or in natural waterways and small depressions and small areas of Owosso soils on the tops of rises or knolls. Also included are small areas of Morley soils and small areas of soils, on the tops of rises or knolls, that have slightly effervescent, mildly alkaline underlying material at a depth of 15 to 20 inches. Areas where slope is greater than 12 percent and small areas of wet soils are identified by spot symbols on the soil map.

The main concerns of management are controlling soil erosion and maintaining organic-matter content and tilth.

This soil is suited to crops commonly grown in the county. Many areas are idle or wooded. A few areas are cropped. Capability unit IIIe–2 (la); woody plant group 2.

Tedrow Series

The Tedrow series consists of somewhat poorly drained, nearly level soils on lake plains, outwash plains, and low beach ridges. These soils formed in waterlain sandy material.

In a representative profile (fig. 15), the surface layer is very dark grayish brown loamy fine sand 9 inches thick. The upper 15 inches of the subsoil is yellowish brown, loose fine sand mottled with dark grayish brown. The lower 18 inches is light yellowish brown, loose fine sand. The underlying material, at a depth of 42 inches, is light yellowish brown fine sand.

Permeability is rapid. The available water capacity is low. Runoff is very slow.

Tedrow soils are moderately well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated, and in some areas specialty crops are grown. The rest is wooded, idle, or in nonfarm uses.

Representative profile of Tedrow loamy fine sand, 0 to 2 percent slopes, in a cultivated field, 144 feet south and 822 feet west of the northeast corner of sec. 31, T. 4 S., R. 8 E.

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

B21—9 to 24 inches, yellowish brown (10YR 5/6) fine sand; common, medium, distinct, dark grayish brown (10YR 4/2) mottles and few, fine, faint, grayish brown (10YR 5/2) mottles; weak, medium, granular structure; loose; few fine roots; medium acid; gradual, wavy boundary.

B22—24 to 42 inches, light yellowish brown (10YR 6/4) fine sand; few, medium, faint, yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; single grained; loose; medium acid; clear, irregular boundary.

C—42 to 60 inches, light yellowish brown (10YR 6/4) fine sand; few, medium, faint, light brownish gray (10YR 6/2) mottles; single grained; loose; neutral.

Thickness of the solum ranges from 24 to 54 inches. Depth to the effervescent material ranges from 35 to more than 60 inches. Reaction ranges typically from medium acid to neutral, but it can range to mildly alkaline in the lower part.

The Ap horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). The content of pebbles is 0 to 1 percent.

Figure 15.—**Profile of Tedrow loamy fine sand showing little horizon distinction below the dark colored surface layer.**

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is fine sand, sand, or loamy sand. Yellowish red (5YR 4/6) concretions are in some pedons.

The C horizon has hue of 10YR and 2.5Y, value of 5 or 6, and chroma of 1 to 4. It is fine sand or sand. A silty clay loam, clay loam, or silt loam horizon occurs below 40 inches in some profiles. The content of pebbles and cobblestones is 0 to 1 percent.

Tedrow soils in most landscapes are near Gilford, Granby, Oakville, Thetford, and Wasepi soils. They lack the gray in the solum that is characteristic of Gilford soils. They have more brown and yellowish brown in the B horizon

than Granby soils and have grayer mottles in the B horizon than Oakville soils. They lack the bands in the B horizon that are characteristic of Thetford soils. They lack the Bt horizon and the gravelly sand C horizon that are characteristic of Wasepi soils.

TeA—Tedrow loamy fine sand, 0 to 2 percent slopes. This soil occurs as irregularly shaped areas on plains. It has the profile described as representative of the series. Areas range from about 5 to 320 acres in size.

Included with this soil in mapping are small areas of Thetford soils, areas of Oakville soils on the tops of ridges or knolls, and small areas of Granby soils in small depressions or natural drainageways. Scattered areas where slope is 3 or 4 percent, small areas of wetter soils, and excavated areas are identified by spot symbols on the soil map.

The main concerns of management are removing excess water, controlling soil blowing, conserving moisture in midsummer, and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops and sod if drained and irrigated. Most areas are cropped. In some areas specialty crops are grown. Some areas are used as a source of sand or are wooded, idle, or in nonfarm uses. Capability unit IIIw–2 (5b) ; woody plant group 2.

TfA—Tedrow loamy fine sand, loamy substratum, 0 to 2 percent slopes. This soil occurs as irregularly shaped areas on plains. It has a profile similar to that described as representative of the series, but it has a loamy substratum below a depth of 40 inches. Areas are 2 to 50 acres in size.

Included with this soil in mapping are small areas of Oakville soils on slightly higher rises, areas of Tedrow soils in small flat areas, and small areas of Thetford soils. Also included are small areas of Selfridge soils in slight depressions or on lower slopes, areas of Granby and Belleville soils in small depressions, areas of soils that have finer textured underlying material, and small areas of soils that have a sandy loam surface layer. Areas of wetter soils and excavated areas are identified by spot symbols on the soil map.

If this soil is drained, droughtiness is a hazard in midsummer. The main concerns of management are removing excess water, controlling soil blowing, conserving moisture in midsummer, and maintaining organic-matter content.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops and sod if drained and irrigated. Most areas are cropped. In some areas specialty crops and sod are grown. The rest is idle, wooded or pastured, or in nonfarm uses. Capability unit IIIw-2 (5/2b) ; woody plant group 2.

Thetford Series

The Thetford series consists of somewhat poorly drained, nearly level soils on outwash plains and lake plains. These soils formed in water-laid sandy and loamy material.

In a representative profile, the surface layer is very dark grayish brown loamy sand 10 inches thick. The subsurface layer, 3 inches thick, is pale brown fine sand mottled with strong brown. The subsoil is 11 inches of strong brown, very friable fine sand mottled with yellowish brown and very pale brown; 11 inches of pale brown, loose fine sand that is mottled with grayish brown and has bands of yellowish brown loamy fine sand; and 8 inches of light gray, loose loamy sand mottled with yellowish brown. The underlying material, at a depth of 43 inches, is light gray fine sand mottled with light olive brown.

Permeability is moderately rapid. The available water capacity is low. Runoff is very slow.

Thetford soils are moderately well suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated, and in some areas specialty crops are grown. The rest is wooded, idle, or in nonfarm uses.

Representative profile of Thetford loamy sand, 0 to 2 percent slopes, in an idle field, 144 feet north and 1,110 feet east of the southwest corner of sec. 7, T. 4 S., R. 8 E.

Ap—0 to 10 inches, very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak, medium, granular structure; very friable; many fine roots; 1 percent pebbles; neutral; abrupt, smooth boundary.

A2—10 to 13 inches, pale brown (10YR 6/3) fine sand; common, medium, distinct, strong brown (7.5YR 5/6) mottles; single grained; loose; few fine roots; 1 percent pebbles; slightly acid; clear, wavy boundary.

B2—13 to 24 inches, strong brown (7.5YR 5/6) fine sand; common, medium, distinct, yellowish brown (10YR 5/6) and very pale brown (10YR 7/4) mottles; weak, medium, granular structure; very friable; few fine roots; 1 percent pebbles; slightly acid; clear, wavy boundary.

A'2&B'2t—24 to 35 inches, pale brown (10YR 6/3) fine sand (A2); common, medium, distinct, grayish brown (10YR 5/2) mottles; single grained; loose; discontinuous, horizontal, thin 1/8- to 2-inch bands of yellowish brown (10YR 5/6) loamy fine sand (Bt); common, medium, distinct, light brownish gray (10YR 6/2) mottles; fine, irregularly shaped, very dark grayish brown (10YR 3/2) manganese concretions; weak, fine, subangular blocky structure; very friable; common, thin clay bridges between sand grains; slightly acid; clear, wavy boundary.

B3—35 to 43 inches, light gray (10YR 6/1) loamy sand; common, medium, distinct, yellowish brown (10YR 5/6) mottles; single grained; loose; neutral; gradual, wavy boundary.

Cg—43 to 60 inches, light gray (10YR 6/1) fine sand; common, medium distinct, light olive brown (2.5Y 5/6) mottles; single grained; loose; discontinuous 1/2-inch band of silty clay loam; massive; firm, mildly alkaline.

Thickness of the solum ranges from 30 to more than 60 inches. Reaction ranges from medium acid to neutral in the upper part and slightly acid to moderately alkaline in the lower part. The content of pebbles throughout the solum is 0 to 5 percent.

The Ap horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), or dark grayish brown (10YR 4/2). The A2 horizon is pale brown (10YR 6/3) fine sand, sand, or loamy sand.

The B2 horizon is yellowish brown (10YR 5/4), strong brown (7.5YR 5/6), light yellowish brown (10YR 6/4), or brown (10YR 5/3). It is dominantly sand or loamy sand, but ranges to fine sand or loamy fine sand. Black (10YR 2/1) concretions are in some pedons. The A'2 part of the A'2&B'2t horizon is light brownish gray (10YR 6/2) or pale brown (10YR 6/3) sand, fine sand, or loamy sand. Depth to the first band of the B'2t horizon is 20 to 30 inches. The B'2t part of the A'2&B'2t horizon is dark brown (10YR 4/3), dark yellowish brown (10YR 4/4), brown (10YR 5/3), or yellowish brown (10YR 5/4, 5/6) loamy sand, loamy fine sand, sand, or sandy loam. Clay bridges between the sand grains are evident. Thickness of the bands

is 1/8 inch to 2 inches, and total thickness is more than 1/10 that of the overlying horizons. The bands are often discontinuous and are 1 to 8 inches apart. The B3 horizon is light gray (10YR 6/1), pale brown (10YR 6/3), brown (10YR 5/3), yellowish brown (10YR 5/4, 5/6), or dark yellowish brown (10YR 4/4) loamy fine sand, loamy sand, sand, or sand that has 1/8- to 1/2-inch bands of loamy sand or sandy loam.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4. It is fine sand or sand in places having discontinuous thin bands of finer textured material. It is mildly or moderately alkaline and has slight effervescence.

Thetford soils in most landscapes are near Granby, Oakville, Spinks, and Tedrow soils. Unlike Granby, Oakville, and Tedrow soils, they have textural bands in the B horizon. Unlike Oakville and Spinks soils, they have gray mottles.

ThA—Thetford loamy sand, 0 to 2 percent slopes. This soil occurs as irregularly shaped areas on plains. Areas range from 3 to 320 acres in size.

Included with this soil in mapping are small areas of Spinks and Oakville soils on slightly higher rises or knolls, small areas of Tedrow soils, and areas of Granby soils in small depressions and natural waterways. Also included are scattered areas where slope is 3 to 4 percent and small scattered areas of soils that have a sandy loam surface layer. Small areas of wetter soils and excavated areas are identified by spot symbols on the soil map.

If this soil is drained, droughtiness is a hazard. The main concerns of management are removing excess water, controlling soil blowing, conserving moisture in midsummer, and maintaining organic-matter content and fertility.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops and sod if drained and irrigated. Most areas are cropped. In a few areas specialty crops and sod are grown. Some areas are wooded, idle, or in nonfarm uses. Capability unit IIIw–2 (4b) ; woody plant group 2.

Wasepi Series

The Wasepi series consists of somewhat poorly drained, nearly level soils on outwash plains, deltas, and lake plains. These soils formed in sandy and gravelly glaciofluvial deposits.

In a representative profile, the surface layer is very dark brown loamy sand 9 inches thick. The upper 6 inches of the subsoil is yellowish brown, very friable loamy sand mottled with very dark grayish brown. The lower 13 inches is yellowish brown, friable sandy loam and grayish brown, very friable, gravelly sandy loam mottled with grayish brown. The underlying material, at a depth of 28 inches, is grayish brown gravelly sand.

Permeability is moderately rapid. The available water capacity is low. Runoff is very slow.

Wasepi soils are suited to crops commonly grown in the county. They are suited to woodland. In many areas these soils are cultivated, and in some areas specialty crops are grown. The rest is wooded or pastured, idle, or in nonfarm uses.

Representative profile of Wasepi loamy sand, 0 to 2 percent slopes, in a cultivated field, 51 feet east and 117 feet south of the northwest corner of SW1/4 sec. 32, T. 3 S., R. 8 E.

Ap—0 to 9 inches, very dark brown (10YR 2/2) loamy sand, grayish brown (10YR 5/2) dry; moderate, medium, granular structure; friable; many fine roots; 10 percent pebbles; medium acid; abrupt, smooth boundary.

B1—9 to 15 inches, yellowish brown (10YR 5/4) loamy sand; common, medium, distinct, very dark grayish brown (10YR 3/2) mottles; weak, medium, granular structure; very friable; few fine roots; 10 percent pebbles; slightly acid; clear, wavy boundary.

B21t—15 to 26 inches, yellowish brown (10YR 5/4) sandy loam; common, medium, distinct, grayish brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; friable; few, thin clay films and clay bridges between sand grains; few fine roots; 10 to 15 percent pebbles; slightly acid; clear, wavy boundary.

B22tg—26 to 28 inches, grayish brown (10YR 5/2) gravelly sandy loam; common, medium, distinct, yellowish brown (10YR 5/4) mottles and common, medium, faint, light gray (10YR 6/1) mottles; weak, medium, granular structure; very friable; few, thin clay films and clay bridges between sand grains; 20 percent pebbles; slight effervescence; mildly alkaline; abrupt, wavy boundary.

IIcg—28 to 60 inches, grayish brown (10YR 5/2) gravelly sand; single grained; loose; 15 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum is 20 to 40 inches and corresponds to depth of effervescent soil material. Reaction ranges from medium acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part.

The Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1), very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), or dark brown (10YR 3/3). It is gray (10YR 5/1) or grayish brown (10YR 5/2) dry. The content of pebbles is 1 to 15 percent.

The B1 horizon is yellowish brown (10YR 5/4, 5/6), light yellowish brown (10YR 6/4), or dark yellowish brown (10YR 4/4) loamy sand, fine sandy loam, or sandy loam. It does not occur in all pedons. The content of pebbles is 1 to 15 percent. The B2 horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. It is sandy loam or sandy clay loam. The content of pebbles is 1 to 20 percent.

The IIC horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 3. It is gravelly sand or dominantly sand and coarse sand. The content of pebbles is 1 to 30 percent. Horizons of silty clay loam, stratified silty clay loam and silt loam, and silt loam are below a depth of 40 inches in some profiles.

Wasepi soils in most landscapes are near Boyer, Gilford, and Tedrow soils. Unlike Boyer soils, they have grayish mottles in the B horizon. They are browner in the B horizon than Gilford soils. They have a Bt horizon that is lacking in Tedrow soils.

WaA—Wasepi loamy sand, 0 to 2 percent slopes. This soil occurs as irregularly shaped areas on plains. It has the profile described as representative of the series. Areas range from 3 to 320 acres in size.

Included with this soil in mapping are small areas of Boyer soils on slight rises and knolls and small areas of Gilford soils in depressions and natural waterways. Also included are small areas of soils that have a sandy loam surface layer and a sandy clay loam subsoil. Small areas of wetter soils and excavated areas are identified by spot symbols on the soil map.

The main concerns of management are removing excess water, controlling soil blowing, and conserving moisture in midsummer.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops and sod if drained and irrigated. Many areas are cropped. In a few areas, specialty crops and sod are grown. Some areas are wooded, idle, or in nonfarm uses. Capability unit IIIw-2 (4b) ; woody plant group 2.

WeA—Wasepi loamy sand, loamy substratum, 0 to 2 percent slopes. This soil is in long, convex areas that

range from 5 to 140 acres in size. It has a profile similar to that described as representative of the series, but it is underlain by loamy materials below a depth of 40 inches.

Included with this soil in mapping are small areas of Tedrow loamy substratum soils on slightly raised ridges and knolls, areas of other Wasepi soils, and areas of Gilford soils in small depressions and drainageways. Also included are small areas of soils that have a fine sandy loam or sandy loam surface layer. Small areas of wetter soils are identified by spot symbols on the soil map.

If this soil is drained, droughtiness is a hazard in midsummer. The main concerns of management are removing excess water, controlling soil blowing and conserving moisture during midsummer.

This soil is suited to crops commonly grown in the county. It is also suited to specialty crops and sod if drained and irrigated. Most areas are cropped. In some areas specialty crops are grown (fig. 16). The rest is idle or wooded. Capability unit IIIw-2 (4/2b) ; woody plant group 2.

Use and Management of the Soils

This section explains the nationwide capability classification system used by the Soil Conservation Service and suggests use and management of the soils for crops. It includes a table showing predicted yields of the principal crops grown in Wayne County under high management levels. It also suggests use and management of the soils for woodland, wildlife, engineering purposes, community development, and recreation.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of farming. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are farmed, and the way they 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

Figure 16.—Summer squash, an important specialty crop, on Wasepi loamy sand, loamy substratum.

reclamation projects; and does not apply to 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 of groups of soils for range, for trees, or for engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These levels are defined in the following paragraphs.

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

Class I soils have few limitations that restrict their use. There are no class I soils in Wayne County.

Class II soils have moderate limitations that reduce the choice of plants or 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 or to range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuitable for cultivation and restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, although they have other limitations that restrict their use largely to pasture or range, woodland, or wildlife habitat.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIw-3 or IIIw-4. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The capability classification of the soils in Wayne County is given in the "Guide to Mapping Units" at the end of this survey. For a complete explanation of the capability classification system, see Agriculture Handbook No. 210, Land Capability Classification *(6)*.

Management by capability units [2]

An adequate supply of plant nutrients and organic matter, a deep root zone, and the proper balance of air and water are needed for good crop growth. Drainage, control of erosion, rotation of crops, use of suitable crop varieties, and the adequate use of lime and fertilizer are the chief management needs. Lime and fertilizer should be applied according to soil tests and the needs of the crops. Special care is needed if muck soils are fertilized.

Many of the soils in Wayne County, such as Pewamo and Granby soils, need artificial drainage. Spring planting, spraying, and harvesting are hampered and weed control is more difficult in areas where drainage is poor. Drainage of cropland improves the air-water relationship in the root zone. Tile drains or surface drainageways or both can be used to remove excess water, but they should be properly designed. Suitable outlets are difficult to find in some areas, particularly in Pella and Houghton soils. Diversions can be installed in some areas to carry runoff. Good soil structure and an ample supply of organic matter also benefit soil drainage. Low-lying areas are subject to a short growing season because of frost late in spring and early in fall. Some low areas where water stands for more than a few days or weeks are especially valuable for wildlife and should not be drained.

The loss of surface soil through erosion reduces soil productivity and increases the sediment in streams and other bodies of water. This water erosion is common in the steeper areas of Morley and St. Clair soils. Erosion generally can be controlled by reducing the rate and volume of runoff and by increasing the rate of water absorption into the soil. Soil loss through surface runoff is reduced by growing meadow crops, cover crops, or green manure crops and by properly using crop residue. Contour cultivation, stripcropping, grassed waterways, minimum tillage, and diversions and terraces are other measures effective in controlling erosion. Windbreaks of trees or shrubs help to control soil blowing on Houghton and other muck soils and on Oakville and

[2] RICHARD H. DRULLINGER, agronomist, Soil Conservation Service, helped prepare this section.

other very sandy soils. Reducing the width of fields, alternating small grain with strips of row crops, and keeping crop residue or permanent vegetative cover on the soil surface also help to control soil blowing.

Among the practices that maintain and improve organic-matter content and soil tilth are growing cover crops and green manure crops, properly using crop residues, maintaining minimum tillage, and applying livestock manure. Fall plowing on nearly level, poorly drained or somewhat poorly drained soils at the right moisture content can reduce damage to soil tilth and allow earlier tillage the following spring. No fall plowing is advisable on sloping soils or on soils subject to soil blowing. Grazing on wet loamy and clayey soils should be avoided because it results in compaction of the soils and poor tilth. Good management is especially important if the cropping system is intensive or if the cultivation is continuous.

Good management is also needed for intensive pasturing. Intensive use of pasture land for horses is rapidly expanding in Wayne County. Adequate soil drainage results in a longer grazing season and permits a greater selection of pasture and hay plants. Loamy and clayey soils, such as Morley, Blount, Pewamo, or Nappanee, should not be grazed when wet.

Additional help in managing the soils can be obtained by consulting the local representative of the Soil Conservation Service or the Cooperative Extension Service.

On the following pages the capability units in Wayne County are described and use and management is suggested for the soil in each unit. The Arabic numerals designating the units are not consecutive because not all the capability units recognized in Michigan are represented in Wayne County.

The soil series represented is identified in the description of each capability unit, but this does not mean that all the soils of a given series appear in the unit. To find the name of each soil and the capability unit to which it has been assigned, refer to the Guide to Mapping Units.

CAPABILITY UNIT IIe-1

This unit consists of the gently sloping soils of the Owosso and Morley series. These soils are moderately well drained or well drained and have a fine textured to moderately coarse textured subsoil.

The available water capacity is high, and fertility is medium or high. The organic-matter content is moderately low or low. Runoff is slow, and permeability is moderately slow.

Soil blowing and water erosion are the major hazards. The major management needs are controlling soil blowing, preventing soil erosion, and maintaining the supply of organic matter and the tilth of the soil.

The soils in this unit are suited to corn, wheat, oats, soybeans, and hay. Terraces and contour strips can help control erosion, but are difficult to lay out because of the complex slopes. Grassed waterways and stripcropping also help in erosion control. Growing stripcrops and cover crops, and avoiding fall plowing help control soil blowing. Plowing under green manure crops, crop residue, and manure adds organic matter and helps maintain tilth and control erosion. Pasture should not be grazed when wet, especially early in spring.

CAPABILITY UNIT IIw-1

This unit consists of nearly level soils of the Pewamo and Hoytville series. These soils are very poorly drained and poorly drained and have a fine textured or moderately fine textured subsoil.

The available water capacity is moderate or high. Natural fertility is high. Organic-matter content is moderate. Runoff is very slow, and permeability is slow or moderately slow.

The high water table and flooding along small streams and in depressional areas are the major limitations. Other concerns are the potential of frost damage, the difficulty in obtaining tile outlets, the puddling and crusting at the surface, and the bogging down of machinery when the soil is wet. The soils warm up slowly in spring. The major management needs are providing drainage and maintaining good soil tilth.

If adequately drained, these soils are suited to corn, soybeans, and small grain. Forage crops that are tolerant of wetness do well. Tile blinding and closely spaced tile improve drainage. Minimum tillage, crop residue, and green manure crops help improve tilth and control erosion. Pastures should not be grazed when wet because the soils tend to puddle.

CAPABILITY UNIT IIw-2

This unit consists of nearly level to gently sloping Blount and Pewamo soils. The Pewamo soil in this unit is mapped with the Blount soil. These soils are somewhat poorly drained to very poorly drained and are moderately fine textured or fine textured in the subsoil.

The available water capacity and natural fertility are high. The organic-matter content is moderately low or moderate. Runoff is slow or very slow, and permeability is moderately slow.

The high water table is the major limitation. Other concerns are the puddling and crusting at the surface, the difficulty in obtaining tile outlets, the flooding in depressional areas, the potential frost damage, and the bogging down of machinery when the soils are wet. Erosion is a hazard on the higher slopes.

A complete drainage system is required for optimum crop production on the Blount-Pewamo loams. The Pewamo soil dries out more slowly in spring than the Blount soil and thus delays planting. The major management needs are providing drainage and maintaining tilth and the supply of organic matter.

If adequately drained, the soils in this unit are suited to corn, wheat, oats, and soybeans. Forage crops that are tolerant of wetness do well. Plowing under green manure crops, crop residue, and manure adds organic matter and helps maintain tilth and control erosion. Minimum tillage also helps maintain tilth and control ersosion. Pasture should not be grazed when wet, especially early in the growing season.

CAPABILITY UNIT IIw-3

This unit consists of nearly level to gently sloping soils of the Kibbie, Pella, and Shoals series. These soils

are somewhat poorly drained or poorly drained and have a moderately fine textured or medium textured subsoil.

The available water capacity is high or very high, and natural fertility is medium or high. The organic-matter content is moderate or high. Runoff is slow to ponded, and permeability is moderate.

The high water table is the major limitation. Flooding early in spring, and late fall in some years, is common on the Shoals soil. Flooding for short periods is common on the Pella soil along streams and drainageways and in depressional areas. Other concerns are the difficulty in obtaining tile outlets, the potential frost damage, the bogging down of machinery when the soils are wet, the puddling and crusting on the Pella and Shoals soils, and the slow warming up of the soils in spring. The major management needs are providing drainage, protecting the soil from flooding, maintaining the organic-matter content, and maintaining tilth.

If adequately drained, these soils are suited to corn, soybeans, and small grain. Forage crops that are tolerant of wetness do well. Tile trenches should be dug in these soils only during the driest part of the year, because the soils are unstable and flow when wet. Tile blinding helps keep drains free. The likelihood of flood damage can be reduced by selecting row crops and forage crops that can be planted late. The risk of frost damage can be reduced by selecting frost-hardy crops. Plowing under green manure crops, manure, and crop residue adds organic matter and helps control erosion. Minimum tillage helps maintain the tilth of the soils as well as control erosion.

CAPABILITY UNIT IIw-4

This unit consists of nearly level to gently sloping soils of the Metamora, Corunna, and Pewamo series. These soils are somewhat poorly drained to very poorly drained. The subsoil ranges from coarse textured to moderately fine textured. The underlying material is moderately fine textured. The Pewamo soil in this unit is mapped with the Metamora soil.

The available water capacity is high, and natural fertility is medium or high. The organic-matter content is moderately low or moderate. Runoff is slow to ponded. Permeability is mostly moderately slow to moderate.

The high water table and soil blowing are the major problems. In areas of the Metamora and Pewamo soils, the Metamora sandy loam dries out sooner in spring than the Pewamo loam. Planting is delayed because of the low wet areas of Pewamo soils, which are subject to flooding in spring. Pewamo soils puddle readily if tilled when wet. Tile is difficult to install because of the uneven short slopes, and outlets are hard to find in some areas. Corunna soils warm up slowly in spring and are also subject to flooding. Frost damage is a hazard. The major management needs are providing drainage, maintaining soil tilth, controlling soil blowing, and maintaining the supply of organic matter.

If adequately drained, the soils in this unit are suited to corn, wheat, oats, soybeans, and hay. Tile blinding helps keep the drains free. Growing stripcrops and cover crops and avoiding fall plowing help control soil blowing. Plowing under green manure crops, crop residue, and manure adds organic matter and helps maintain tilth and control erosion. Minimum tillage helps control soil blowing on the Metamora soil.

CAPABILITY UNIT IIIe-1

The one soil in this unit, St. Clair clay loam, 2 to 6 percent slopes, is moderately well drained or well drained and has a fine textured subsoil.

The available water capacity is moderate, and the natural fertility is high. The organic-matter content is low. Runoff is slow, and permeability is very slow.

Erosion is the major hazard. Scattered wet depressions may hinder machinery, and the soil puddles and crusts when wet. The major management needs are preventing erosion and maintaining tilth and the supply of organic matter.

This soil is suited to corn, wheat, oats, soybeans, and hay. In some places erosion has reduced the thickness of the surface layer, thereby exposing the subsoil and resulting in poor soil tilth. Terraces and contour strips can help control erosion, but are difficult to lay out because of the complex slopes. Grassed waterways, stripcrops, and cover crops can help control erosion. Plowing under green manure crops, crop residue, and manure adds organic matter and helps control erosion. Minimum tillage helps maintain tilth and also helps in erosion control. Pastures should not be grazed when wet, especially early in spring.

CAPABILITY UNIT IIIe-2

The one soil in this unit, St. Clair clay loam, 6 to 12 percent slopes, is moderately well drained or well drained and has a fine textured subsoil.

The available water capacity is moderate, and natural fertility is high. The organic-matter content is low. Runoff is medium, and permeability is very slow.

Erosion and strong slopes are the major concerns of management. Scattered wet depressions may hinder machinery, and the soil puddles and crusts if worked when wet. The major management needs are controlling erosion and maintaining tilth and the supply of organic matter.

This soil is suited to corn, wheat, oats, and hay. Crops are likely to lack sufficient moisture during dry periods, because runoff is medium and little of the rainfall is absorbed. In some places erosion has reduced the thickness of the surface layer, thereby reducing organic matter and fertility and resulting in poor soil tilth.

Because of the erosion hazard, cropping systems should consist largely of close-growing crops. Pastures should not be grazed when wet, especially early in the growing season. Terraces and contour strips can help control erosion, but are difficult to lay out because of the complex slopes. Grassed waterways, stripcrops, and cover crops can help control erosion. Plowing under green manure crops, crop residue, and manure adds organic matter and helps control erosion. Minimum tillage helps maintain good soil tilth and also helps in erosion control.

CAPABILITY UNIT IIIe-3

This unit consists of sloping Owosso and Morley soils and the gently sloping Metea soil. The Owosso soil in this unit is mapped with Morley soil. All of the soils are moderately well drained or well drained. Morley soils are moderately fine textured and fine textured in the subsoil. Owosso soils have a moderately coarse textured and moderately fine textured subsoil. Metea soils have a subsoil that is coarse textured in the upper part and moderately fine textured in the lower part.

The available water capacity is high in Morley and Owosso soils and moderate in the Metea soil. Natural fertility is low in the Metea soil, medium in the Owosso soil, and high in the Morley soil. The organic-matter content is low or moderately low. Runoff is very slow on the Metea soil, slow on Owosso, and medium on Morley. Permeability of the soils in this unit is moderate or moderately slow.

Soil blowing, droughtiness, soil erosion, and slope are the major concerns of management. In small areas erosion has reduced the fertility of the soils. In eroded areas the Morley soil puddles and crusts when wet and is hard to work when dry. The major management needs are controlling soil blowing, conserving soil moisture during dry periods, maintaining the level of fertility, maintaining the supply of organic matter, controlling erosion, and maintaining tilth.

The soils in this unit are suited to crops, such as corn, soybeans, small grain, and hay. Cropping systems that are dominantly close-growing crops are needed to check runoff and control erosion. Crops that resist drought and mature early do best on the Metea soil. Deep-rooted forage plants are more productive than other plants on the Metea soil. Terraces and contour strips can help control erosion on soils in this unit, but are difficult to lay out because of the complex slopes. Stripcrops, cover crops, grassed waterways, and no fall plowing can help control erosion and soil blowing. Plowing under green manure crops, crop residue, and manure increases fertility, adds organic matter, helps hold soil moisture, and also helps maintain tilth and control erosion. Pasture should not be grazed when wet, especially on the Morley soils early in spring. Minimum tillage helps maintain tilth and also helps in erosion control.

CAPABILITY UNIT IIIe-4

This unit consists of sloping soils of the Boyer and Spinks series. These soils are well drained. The Boyer soil has a moderately fine textured to coarse textured subsoil and coarse textured underlying material. The Spinks soil is coarse textured throughout.

The available water capacity and natural fertility are low. The organic-matter content is very low or low. Runoff is slow or medium, and permeability is rapid or moderately rapid.

Water erosion, soil blowing, slope, and droughtiness are the major concerns of management. The soils warm up early in spring and are ready for planting. They are easy to till. The major management needs are controlling soil blowing, controlling soil erosion, conserving moisture, and maintaining the level of fertility and the supply of organic matter.

These soils are suited to corn, wheat, oats, soybeans, and hay. A small grain crop is better suited than corn because it normally matures before the drier part of summer. Terraces and contour strips can help control erosion, but are difficult to lay out because of the complex slopes. Stripcrops, cover crops, waterways, and no fall plowing help control soil erosion and soil blowing. Where stripcropping is difficult, the proportion of close-growing crops in the cropping system needs to be increased. Plowing under green manure crops, crop residue, and manure increases fertility, supplies organic matter, helps hold soil moisture, and helps control erosion.

CAPABILITY UNIT IIIw-1

The one soil in this unit, Nappanee silt loam, 0 to 4 percent slopes, is somewhat poorly drained. It is fine textured in the subsoil.

The available water capacity is moderate, and natural fertility is high. The organic-matter content is moderately low. Runoff is slow, and permeability is very slow.

Wetness is the major limitation. Other concerns are frost damage in the low areas, soil erosion in the gently sloping areas, and water standing in depressions. The soil warms up slowly in spring. It puddles and crusts when wet. Tile outlets are difficult to obtain. The major management needs are providing drainage and maintaining tilth and the supply of organic matter.

If adequately drained, this soil is suited to corn, wheat, oats, soybeans, and hay. Plowing under green manure crops, crop residue, and manure adds organic matter and helps maintain tilth and control erosion. Pastures should not be grazed when wet because the soil tends to puddle.

CAPABILITY UNIT IIIw-2

This unit consists of nearly level soils of the Tedrow, Thetford, and Wasepi series. All are somewhat poorly drained. Tedrow and Thetford soils have a coarse textured subsoil. Wasepi soils have a coarse textured and moderately coarse textured subsoil.

The available water capacity is low or moderate. Natural fertility is low or medium. The organic-matter content is low to moderate. Runoff is very slow. Permeability is moderately slow in the loamy substratum of the Tedrow and Wasepi soils and moderately rapid to rapid in the rest of the soils.

The high water table, soil blowing, and droughtiness are major problems. There is a potential for frost damage in the low wet depressional areas, and scattered wet depressions may hinder machinery for a short period. When the water table is lowered, these soils dry out quickly and become droughty. The major management needs are providing drainage, controlling soil blowing, conserving moisture, and maintaining the level of fertility and the supply of organic matter.

If adequately drained and fertilized, these soils are suited to corn, wheat, oats, soybeans, and hay. Tile trenches and ditches should be dug during the driest

part of the year, because the soils are unstable and flow when wet. Tile blinding is needed to keep the drains free.

Stripcrops and cover crops are excellent for control of soil blowing. Windbreaks, mulches, and crop residue on the surface also help. Plowing under green manure crops, crop residue, and manure increases fertility, adds organic matter, and helps hold soil moisture. Fall plowing should be avoided because of soil blowing.

CAPABILITY UNIT IIIw-3

This unit consists of nearly level soils of the Gilford and Granby series. These soils are poorly drained or very poorly drained. The Gilford soil has a coarse textured or moderately coarse textured subsoil and coarse textured underlying material. The Granby soil has a coarse textured subsoil and underlying material.

The available water capacity is low, and natural fertility is medium. Organic-matter content is moderate or high. Runoff is very slow or ponded, and permeability is moderately rapid or rapid.

Depressional areas are subject to flooding by runoff from adjacent areas. When the water table is lowered, the soils tend to be droughty and are likely to blow. Sidewall instability and difficulty in locating tile outlets can also be a problem. The major management needs are providing drainage, controlling soil blowing, conserving moisture in midsummer, and maintaining the level of fertility and the supply of organic matter.

If adequately drained, the soils in this unit are suited to corn, soybeans, wheat, oats, and hay. Tile trenches and ditches should be dug only during the driest part of the year because the soils are unstable and flow when wet. Tile blinding is needed to keep the drains free. Stripcrops, cover crops, mulches, windbreaks, minimum tillage, and no fall plowing help control soil blowing. Plowing under green manure crops, crop residue, and manure increases fertility and helps hold more soil moisture.

CAPABILITY UNIT IIIw-4

This unit consists of nearly level to gently sloping Selfridge and Metea soils and nearly level Belleville and Pewamo soils. Pewamo and Metea soils are mapped with Selfridge soils. Belleville and Pewamo soils are very poorly drained and poorly drained. Selfridge soils are somewhat poorly drained, and Metea soils are well drained. All but Pewamo soils have a coarse textured subsoil. Pewamo soils have a moderately fine textured subsoil. All are underlain by moderately fine textured material.

The available water capacity is moderate or high. Natural fertility is high in Pewamo soils, but low in the rest. The organic-matter content is low to moderate. Runoff is very slow or ponded, and depressional areas of Belleville and Pewamo soils are subject to flooding. Permeability is moderately slow in Pewamo soils. It is rapid in the upper part of Selfridge, Metea, and Belleville soils and moderate or moderately slow in the lower part.

The major problems are soil blowing, droughtiness, and a high water table. If the water table is lowered, Belleville and Selfridge soils dry out quickly and become droughty in midsummer. Metea soils are droughty. Tile drains and ditches are best installed in Belleville and Selfridge soils during dry periods because ditchbanks and trenches cave in readily when these soils are wet. The depth and the spacing of tile drains depend on the depth to the underlying material. Outlets can be difficult to obtain, and tile blinding is needed in Belleville and Selfridge soils. Undrained soils remain wet and warm up slowly in spring. Pewamo soils puddle and crust if tilled when wet. Frost damage is a hazard in lower lying areas. The major management needs are providing drainage, controlling soil blowing, conserving moisture, maintaining the level of fertility and the supply of organic matter, and maintaining tilth.

These soils are suited to corn, wheat, oats, soybeans, and hay. A small grain does better than corn because it matures before the drier part of summer. Crops mature faster on Selfridge and Metea soils than on the Pewamo soil. If planting is delayed in spring, crops grow well on the Pewamo soil but may lack moisture on Metea and Selfridge soils. In contrast, crops planted before the Pewamo soil dries out are stunted or drowned out, but do well on Metea and Selfridge soils. Stripcrops, mulches, cover crops, windbreaks, and no fall plowing help control soil blowing. Minimum tillage also is beneficial. Plowing under green manure crops, crop residue, and manure increases fertility, adds organic matter, improves tilth, helps hold soil moisture, and helps control erosion. These soils should not be summer fallowed because of soil blowing.

CAPABILITY UNIT IIIw-5

The one soil in this unit, Houghton muck, is a nearly level, very poorly drained organic soil.

The available water capacity is very high, and natural fertility is low. Runoff is very slow or ponded, and permeability is rapid. Flooding is a hazard.

A high water table, soil blowing, and the poor stability of the soil material are the major problems. Tile outlets are hard to locate. Farm machinery bogs down readily when the soil is saturated. If the water table is lowered too much, the organic material settles and dries out so much that soil blowing and fire are hazards. Wind blows out newly seeded crops and fills drainage ditches with drifting soil material. Frost damage to crops is also a hazard. The major management needs are providing drainage, controlling soil blowing, and maintaining the level of fertility.

If adequately drained and fertilized, this soil is suited to corn, wheat, oats, and soybeans. The water table should be low enough that crops can be grown, but not so low as to result in droughtiness or soil blowing. The risk or settling can be reduced by keeping the water table near the surface in areas where no crop is grown. Compaction of the surface layer, stripcropping, and the use of buffer strips and windbreaks help control soil blowing. When installing tile drainage, tile blinding is needed.

CAPABILITY UNIT IIIs-1

This unit consists of nearly level to gently sloping soils of the Boyer and Spinks series. These soils are

well drained. The Boyer soil has a moderately fine textured subsoil and coarse textured underlying material. The Spinks soil has a coarse textured subsoil and coarse textured underlying material.

The available water capacity, natural fertility, and organic-matter content are low. Runoff is very slow or slow. Permeability is moderately rapid or rapid.

Soil blowing and droughtiness are the major concerns of management. The Spinks soil is more droughty and more susceptible to blowing than the Boyer soil. These soils warm up early in spring and are ready for planting. They are easy to till, but excessive tillage increases the hazard of erosion. The major management needs are controlling soil blowing, conserving moisture, and maintaining the level of fertility and the supply of organic matter.

These soils are suited to corn, wheat, oats, soybeans, and hay. A small grain crop is better suited than corn because it matures before the drier part of summer. Windbreaks, stripcrops, cover crops, and no fall plowing are ways to control soil blowing. Plowing under green manure crops, crop residue, and manure increases fertility, supplies organic matter, and helps hold soil moisture.

CAPABILITY UNIT IVe-1

The one soil in this unit, Morley loam, 12 to 18 percent slopes, is well drained to moderately well drained and has a moderately fine textured subsoil.

The available water capacity is high. Natural fertility is high. Organic-matter content is low. Runoff is rapid, and permeability is moderately slow.

The major hazard is water erosion. In addition, the soil puddles and crusts if tilled when wet. In eroded areas, the subsoil is hard to work and the tilth is poor. Fall plowing increases the hazard of erosion and should be avoided. The major management needs are preventing erosion and maintaining the supply of organic matter and the tilth of the soil.

This soil is suited to crops. Forage crops and an occasional crop of small grain can be grown. Only an occasional row crop should be grown. Terracing and stripcropping usually are difficult to lay out because of the short, complex slopes. Minimum tillage, grassed waterways, and long rotations reduce the hazard of erosion and improve soil tilth. Pastures should not be grazed when wet, especially early in the growing season. The supply of organic matter can be increased by plowing under hay crops and cover crops.

CAPABILITY UNIT IVw-1

The one soil in this unit, Edwards muck, is nearly level. It is a very poorly drained organic soil over marl.

The available water capacity is very high, and natural fertility is low. Organic-matter content is high. Runoff is very slow or ponds, and permeability is rapid.

The major factors affecting use are a high water table, soil blowing, and poor stability of the soil material. Farm machinery bogs down readily when the soil is saturated. If the water table is lowered too much, the thin layer of organic material settles and dries out and blows away. After a few years, only the marl material is left. Wind action thins the layer of organic material, blows out newly seeded crops, and fills drainage ditches with drifting soil material. Some areas are difficult to drain because the marl is so close to the surface. Tile outlets are difficult to obtain. In addition, the soil is subject to flooding and frost damage. The major management needs are providing drainage, controlling soil blowing, and maintaining fertility.

If adequately drained and fertilized, this soil is suited to corn, wheat, oats, and soybeans. The marl below the muck restricts the growth of deep rooted crops. The water table should be low enough that crops can be grown, but not so low that the lack of soil moisture results in droughtiness or intensifies soil blowing. Compaction of the surface layer, stripcrops, buffer strips, and windbreaks help control soil blowing. When installing tile, tile blinding is needed.

CAPABILITY UNIT IVs-1

The one soil in this unit, Oakville fine sand, 0 to 6 percent slopes, is moderately well drained to well drained and has a coarse textured subsoil and coarse textured underlying material.

The available water capacity, natural fertility, and the organic-matter content are low. Runoff is very slow or slow, and permeability is very rapid.

Soil blowing and droughtiness are the major concerns of management. This soil warms up early in spring and is ready for planting. It is easy to till, but excessive tillage increases the hazard of soil blowing. The low available water capacity and the very rapid permeability make this soil very droughty, unless rainfall is frequent. The major management needs are controlling soil blowing, conserving moisture, and maintaining the level of fertility and the supply of organic matter.

This Oakville soil is suited to such crops as wheat, oats, and hay. Crops show the effects of droughtiness sooner than on most of the other soils in the county. In extremely dry years, such shallow-rooted crops as corn do not mature because they lack moisture. Forage crops are productive early in the growing season, and so are crops that mature before the drier part of summer. Minimum tillage reduces the loss of moisture through evaporation. Windbreaks, minimum tillage, cover crops, stripcrops, and mulches can be used to control soil blowing. Plowing under green manure crops, residue, and manure increases fertility, adds organic matter, and helps hold soil moisture.

CAPABILITY UNIT Vw-1

This unit consists of nearly level soils of the Sloan and Cohoctah series. These soils are poorly drained or very poorly drained. The Sloan soils have a moderately fine textured subsoil, and the Cohoctah a coarse textured and moderately coarse textured subsoil.

The available water capacity is moderate or high, and natural fertility is medium or high. The organic-matter content is high. Runoff is very slow or ponded, and permeability is moderate or moderately rapid.

The high water table and frequent flooding are the major concerns of management. Another concern is the difficulty of obtaining tile outlets, the potential frost

damage, the slow warmup of soils in spring, and the bogging down of machinery when the soils are wet. The major management needs are providing drainage and protecting the soils from flooding.

Unless drained and protected from flooding, the soils in this unit are not suited to crops. If drained, they are suited to crops, such as wheat, oats, corn, and soybeans. Forage crops that are tolerant of wetness do well. Drainage tile should be covered, when it is installed, with fiber glass, grass clippings, or straw.

CAPABILITY UNIT VIIIw-1

This unit consists only of Marsh, which has standing water at the surface or a water table at or very near the surface throughout the year. The soils are dominantly alluvial mineral. Some are organic. Most areas are along the mouth of the Huron and Detroit Rivers at their confluence with Lake Erie.

The standing water for much of the year limits access. Marsh is suited to some types of recreational use and to wildlife habitat. It is not suited to pasture or crops.

Predicted Yields

The soils of Wayne County vary considerably in productivity. Some soils consistently produce high yields of cultivated crops. Others are better suited to less intensive uses because of hazards or soil limitations. The average yields per acre of the principal crops on arable soils of the county are listed in table 2.

TABLE 2.—*Predicted average yields per acre of principal crops under a high level of management*

[Absence of data indicates that the crop is not suited to the soil or is not ordinarily grown on it. Only arable soils are listed]

Soil	Corn for grain	Corn for silage	Oats	Wheat	Soybeans	Timothy-red clover hay	Grass hay
	Bu	*Tons*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Belleville loamy fine sand	80	15	60	45	35	2.5	3.0
Blount loam, 0 to 4 percent slopes	105	17	70	48	35	3.5	3.0
Blount-Pewamo loams, 0 to 2 percent slopes	105	17	85	50	40	3.2	3.0
Boyer loamy sand, 0 to 6 percent slopes	70	13	50	35	30	2.7	2.5
Boyer loamy sand, 6 to 12 percent slopes	65	11	45	30	25	2.7	2.5
Corunna fine sandy loam	110	18	80	50	40	3.0	4.0
Edwards muck	100	17	----	----	----	----	----
Gilford sandy loam	85	15	65	40	30	2.7	3.0
Granby loamy fine sand	80	14	55	35	28	2.7	3.0
Houghton muck	110	18	----	----	----	----	----
Hoytville silty clay loam	100	17	75	45	42	3.2	3.5
Kibbie fine sandy loam, 0 to 3 percent slopes	110	18	85	55	35	3.2	3.5
Metamora sandy loam, 0 to 3 percent slopes	95	16	75	50	35	3.2	3.2
Metamora-Pewamo complex, 0 to 3 percent slopes	100	17	80	50	35	3.2	3.5
Metea loamy sand, 2 to 6 percent slopes	85	15	60	40	30	2.5	3.0
Morley loam, 2 to 6 percent slopes	95	16	70	50	35	3.0	3.5
Morley loam, 6 to 12 percent slopes	85	16	65	45	30	3.0	3.5
Morley loam, 12 to 18 percent slopes	----	----	60	35	----	2.7	3.0
Nappanee silt loam, 0 to 4 percent slopes	90	15	75	40	32	3.0	3.5
Oakville fine sand, 0 to 6 percent slopes	45	9	44	25	15	2.2	2.2
Owosso-Morley complex, 2 to 6 percent slopes	95	16	75	45	35	3.0	3.5
Owosso-Morley complex, 6 to 12 percent slopes	90	15	75	40	30	3.0	3.5
Pella silt loam	115	18	90	55	40	3.0	4.0
Pewamo loam	110	18	85	55	40	3.2	4.0
Selfridge loamy sand, 0 to 3 percent slopes	90	15	70	40	30	2.7	3.0
Selfridge-Pewamo complex, 0 to 2 percent slopes	100	17	80	50	35	3.0	3.0
Selfridge-Pewamo-Metea complex, 0 to 4 percent slopes	95	16	75	45	30	2.7	3.0
Shoals silt loam	100	17	80	50	38	3.5	3.0
Spinks loamy sand, 0 to 6 percent slopes	65	12	45	30	24	2.5	2.5
Spinks loamy sand, 6 to 12 percent slopes	60	11	40	25	20	2.5	2.5
St. Clair clay loam, 2 to 6 percent slopes	90	15	60	40	30	3.0	3.8
St. Clair clay loam, 6 to 12 percent slopes	85	15	50	40	25	3.0	3.5
Tedrow loamy fine sand, 0 to 2 percent slopes	80	14	50	35	30	2.5	2.8
Tedrow loamy fine sand, loamy substratum, 0 to 2 percent slopes	85	15	50	35	30	2.5	2.5
Thetford loamy sand, 0 to 2 percent slopes	85	15	55	35	32	2.5	3.0
Wasepi loamy sand, 0 to 2 percent slopes	80	14	60	40	35	2.7	3.0
Wasepi loamy sand, loamy substratum, 0 to 2 percent slopes	85	15	65	45	35	2.7	3.0

The yields listed in table 2 are the averages for crops grown under high level management. Under this level of management the cropping system is adapted to the soil, using the proper proportion of row crops to legume-grass crops. The crop sequence is supplemented by conservation measures needed to control water erosion and soil blowing, which may include contour tillage, stripcropping, minimum tillage, and return of crop residue to the soil surface. The quantity of lime applied is determined by soil test. Fertilizer application is also determined by soil test and is based on the amounts and kinds of plant nutrients needed by the crop. If needed, an adequate system of artificial drainage is installed. Improved varieties of plants and high quality seeds are used. Weed, disease, and insect control is practiced. Suitable methods and proper timing of tillage and harvesting are used. Cover crops, crop residue, and manure are returned to the soil to improve soil structure, supply organic matter, and control erosion.

The crop yields listed are those that are expected over a period of several years under high management. The yields are not presumed to be the maximum obtainable. Maximum yields can be considerably higher in years when soil, plant, and weather conditions are favorable. Irrigation has not been considered a part of improved management. It is limited mainly to potato, truck, and fruit crops.

These yields are predictions of relative productivity for the soils in the Wayne County Area. The actual yield figures, although they will become outdated with time, will serve as a guide in comparing productivity among soils of the county.

Landscaping and Windbreaks [3]

Homeowners and landscape architects must know the kinds of soils in an area in order to make the proper choices of trees and shrubs for landscape plantings and windbreaks.

The soils in Wayne County Area have been assigned to woody plant groups, each of which is suited to similar kinds of shrubs and trees. The groupings are for soils in their natural state, except for soils in group 1, which have been drained. Table 3 shows the height at maturity, the shape, the width, and the shade tolerance of the trees and shrubs suitable for each group. Only suitable soils are listed. The woody plant group for an individual soil is shown in the Guide to Mapping Units.

[3] JACQUES J. PINKARD, forester, Soil Conservation Service, prepared this section.

TABLE 3.—*Suitable trees and shrubs for landscaping and windbreaks*

[Suitable plants for windbreaks are shown by an asterisk]

Woody plant groups and map symbols	Suitable trees and shrubs	20-year height	Shape	Shade tolerance
		Feet		
Group 1: Ed, Hn	American cranberrybush *	10	Oval	No.
	Amur privet *	12	Rounded	No.
	Austrian pine *	22	Pyramidal	No.
	Eastern hemlock	20	Pyramidal	Yes.
	Eastern white pine *	22	Pyramidal	Yes.
	Green ash *	37	Oval	No.
	Laurel willow *	24	Oval	No.
	Northern white-cedar *	29	Columnar	Yes.
	Nannyberry viburnum *	18	Rounded	No.
	Norway spruce *	27	Conical	No.
	Red maple	46	Oval	Yes.
	Red-osier dogwood	9	Mound	Some.
	Scotch pine *	31	Pyramidal	No.
	Silky dogwood *	9	Rounded	No.
	Tamarack *	16	Conical	No.
	Tatarian honeysuckle *	15	Rounded	No.
	Vanhoutte spirea *	7	Rounded	No.
	White spruce *	13	Conical	Some.
Group 2: BbB, BcA, KnA, MeA, MfA, NaB, Se, SfA, SgB, ShB, StB, StC, TeA, TfA, ThA, WaA, WeA. For Pewamo part of BcA, MfA, SfA, and SgB, see Group 5; for Metea part of SgB, see Group 5.	American basswood	30	Round	Some.
	American cranberrybush *	8	Oval	No.
	Amur privet *	11	Rounded	No.
	Austrian pine *	22	Pyramidal	No.
	Black walnut	26	Rounded	Some.
	Blue spruce *	9	Conical	No.
	Eastern redcedar	14	Conical	No.
	Eastern white pine *	24	Pyramidal	Yes.
	Green ash *	39	Oval	No.
	Late lilac *	12	Oval	No.
	Laurel willow *	29	Oval	No.
	Northern white-cedar *	23	Columnar	Yes.
	Norway spruce *	26	Conical	Some.
	Red maple	46	Oval	Some.

TABLE 3.—*Suitable trees and shrubs for landscaping and windbreaks*—Continued

Woody plant groups and map symbols	Suitable trees and shrubs	20-year height	Shape	Shade tolerance
		Feet		
Group 3: BnB, BnC, MhB, OaB, SpB, SpC.	Red pine *	26	Pyramidal	No.
	Siberian crabapple	25	Vase	No.
	Silky dogwood	10	Rounded	No.
	Tall purple willow	25	Oval	No.
	Tatarian honeysuckle *	12	Rounded	No.
	Vanhoutte spirea *	7	Rounded	No.
	White ash *	39	Round	No.
	White spruce *	14	Conical	Some.
	Whitebelle honeysuckle *	10	Rounded	No.
	American mountainash *	23	Oval	No.
	Amur privet *	10	Rounded	No.
	Autumn-olive *	10	Oval	No.
	Creeping juniper	1	Flat	No.
	Eastern redcedar *	20	Conical	No.
	Eastern white pine *	28	Pyramidal	Yes.
	Hawthorn *	20	Rounded	No.
	Jack pine *	33	Oval	No.
	Lilac *	12	Mound	Some.
	Paper birch	30	Oval	Some.
	Red pine *	30	Pyramidal	No.
	Scotch pine *	30	Pyramidal	No.
	Siberian crabapple *	18	Vase	No.
	Tatarian honeysuckle *	8	Rounded	No.
	Vanhoutte spirea *	6	Rounded	No.
Group 4: MoB, MoC, MoD, OwB, OwC.	White spruce *	12	Pyramidal	Some.
	American basswood	35	Round	Some.
	Amur privet *	12	Rounded	No.
	Austrian pine	25	Pyramidal	No.
	Autumn-olive *	15	Oval	No.
	Black walnut	23	Round	Yes.
	Eastern white pine *	28	Pyramidal	Yes.
	Flowering dogwood	13	Flat-top	Yes.
	Green ash	49	Oval	No.
	Hackberry	28	Pyramidal	Some.
	Juneberry *	12	Oval	Yes.
	Late lilac *	14	Oval	No.
	Laurel willow *	25	Oval	No.
	Lilac *	14	Oval	Yes.
	Northern pin oak *	28	Pyramidal	No.
	Northern white-cedar *	19	Columnar	Yes.
	Norway spruce *	26	Conical	No.
	Red pine *	22	Pyramidal	No.
	Scotch pine *	31	Pyramidal	No.
	Shagbark hickory	30	Oval	Some.
	Silky dogwood	9	Rounded	No.
	Tatarian honeysuckle *	7	Rounded	No.
	White spruce *	20	Conical	Yes.
	Vanhoutte spirea *	7	Rounded	No.
	Whitebelle honeysuckle *	9	Rounded	No.
Group 5: Ba, Cc, Co, Gf, Gr, Ho, Pc, Pe, So.	American elder	9	Rounded	No.
	American sycamore	27	Rounded	Yes.
	Amur privet *	8	Rounded	No.
	Arrowwood *	12	Rounded	No.
	Black cherry	40	Oval	Some.
	Eastern hemlock	21	Pyramidal	Yes.
	Eastern white pine *	17	Pyramidal	Yes.
	Green ash	25	Oval	No.
	Hawthorn *	15	Rounded	No.
	Laurel willow *	22	Oval	No.
	Northern white-cedar *	21	Columnar	Yes.
	Norway spruce *	25	Conical	No.
	Paper birch	31	Oval	Some.
	Siberian crabapple *	15	Vase	No.
	Silky dogwood *	8	Rounded	No.
	Tamarack *	16	Pyramidal	No.
	White spruce	10	Pyramidal	No.
	Whitebelle honeysuckle *	10	Rounded	No.

TABLE 4.—*Suitability of soils for elements of wild-*

Soil series and map symbols	Suitability for elements of habitat—			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Belleville: Ba	Poor	Fair	Fair	Fair
Blount:				
BbB	Fair [1]	Good	Good	Good
BcA	Fair [1]	Good	Good	Good
For Pewamo part, see Pewamo series.				
Boyer: BnB, BnC	Poor	Fair	Good	Good
Cohoctah: Cc	Poor	Fair	Fair	Fair
Corunna: Co	Good [1]	Fair	Fair	Fair
Cut and fill land: Cu. Too variable to be rated.				
Edwards: Ed	Very poor	Poor	Poor	Poor
Gilford: Gf	Fair [1]	Poor	Poor	Poor
Granby: Gr	Poor	Fair	Fair	Fair
Houghton: Hn	Fair [1]	Poor	Poor	Poor
Hoytville: Ho	Good [1]	Poor	Poor	Poor
Kibbie: KnA	Good [1]	Good	Good	Good
Made land: Ma. Too variable to be rated.				
Marsh: Mb	Very poor	Very poor	Very poor	Very poor
Metamora: MeA, MfA	Good	Good	Good	Good
For Pewamo part of MfA, see Pewamo series.				
Metea: MhB	Poor	Fair	Good	Good
Morley:				
MoB	Good	Good	Good	Good
MoC	Fair	Good	Good	Good
MoD	Poor	Fair	Good	Good
Nappanee: NaB	Good	Good	Good	Good
Oakville: OaB	Poor	Poor	Fair	Fair

Plantings are needed for erosion control, for farm and home windbreaks, for landscaping building sites, for establishing areas for wildlife food and cover, and for beautification. Many plantings can serve a dual purpose, for example, some can provide wildlife food and cover and also serve as windbreaks and improve the environment. Successful establishment of the plants can be expected if the area is properly prepared before planting and unwanted competing plants are controlled for at least 2 years or until the desired plants are established. The plants listed in each woody plant group are some of those commonly grown, but others may also be suitable. Some of the plants, as shown in table 3, are listed as suitable for more than one group.

Wildlife [4]

Proper management of soil, water, and plants to produce suitable habitat is the most effective way to maintain and improve wildlife populations.

[4] By CHARLES M. SMITH, biologist, Soil Conservation Service.

Table 4 rates the soils according to the level of suitability for elements of wildlife habitat and for general kinds of wildlife. A rating of *good* means that habitat is easily improved, maintained, or created. There are few or no soil limitations to habitat management, and satisfactory results can be expected. A *fair* rating indicates that habitat can be improved, maintained, or created, but moderate soil limitations affect habitat management or development. Moderately intensive management and fairly frequent attention may be required to insure satisfactory results. A rating of *poor* means that habitat can be improved, maintained, or created, but the soil limitations are severe. Habitat management may be difficult and expensive and may require intensive effort. Results are questionable. A rating of *very poor* indicates that, under the prevailing soil conditions, it is impractical to attempt to improve, maintain, or create habitat. Unsatisfactory results are probable. Seven elements of wildlife habitat are defined in the following paragraphs.

life habitat and as habitat for kinds of wildlife

Suitability for elements of habitat—Continued			Suitability as habitat for—		
Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Fair	Fair	Good	Fair	Fair	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Good	Good	Fair	Fair	Good.
Fair	Good	Good	Fair	Fair	Good.
Poor	Good	Good	Very poor	Poor	Good.
Poor	Good	Good	Poor	Poor	Good.
Fair	Fair	Good	Fair	Fair	Fair.
Poor	Good	Good	Poor	Poor	Good.
Poor	Good	Good	Fair	Poor	Good.
Fair	Fair	Fair	Good	Good	Fair.
Very poor	Good	Good	Very poor	Very poor	Good.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.

Grain and seed crops.—Domestic grain or other seed-producing annuals planted to produce wildlife food. Examples are corn, wheat, oats, rye, barley, buckwheat, millet, sorghum, soybeans, and sunflowers.

Domestic grasses and legumes.—Domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples are fescue, timothy, bromegrass, clover, orchardgrass, bluegrass, trefoil, alfalfa, crown vetch, switchgrass, sudangrass, and reed canarygrass.

Wild herbaceous plants.—Native or naturally established herbaceous grasses and forbs (including weeds), commonly grown in upland areas, that provide food and cover for wildlife. Among these are goldenrod, ragweed, nightshade, strawberry, lambsquarters, dandelions, wintergreen, and native grasses.

Hardwood trees.—Nonconiferous or deciduous trees and associated woody understory plants that provide wildlife cover or that produce nuts, buds, catkins, sprouts, twigs, bark, or foliage used as food by wildlife. Representative species are maple, beech, oak, poplar, birch, willow, cherry, ash, walnut, elm, hawthorn, basswood, and serviceberry.

Coniferous plants.—These are cone-bearing trees, shrubs, or ground cover that furnish wildlife cover and food in the form of browse, seeds, or fruitlike cones. They may be planted or transplanted, but they are commonly established through natural processes. Examples are pine, spruce, hemlock, fir, cedar, larch, juniper, and yew.

Wetland plants.—Annual or perennial wild herbaceous plants in moist or wet sites, exclusive of submerged or floating aquatics, that provide food or cover used extensively by wetland forms of wildlife. Examples are smartweed, wild millet, rushes, sedges, reeds, wild rice, cattail, arrowhead, pickerelweed, and water plantain.

Shallow water areas.—These are areas of surface water, with an average depth of less than 5 feet, that are useful to wildlife. They may be naturally wet areas or areas created by dams or levees or by water-control

TABLE 4.—*Suitability of soils for elements of wild-*

Soil series and map symbols	Suitability for elements of habitat—			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Owosso:				
OwB	Good	Good	Good	Good
For Morley part, see Morley series.				
OwC	Fair	Good	Good	Good
For Morley part, see Morley series.				
Pella: Pc	Good	Poor	Poor	Poor
Pewamo: Pe	Good	Fair	Fair	Fair
Selfridge: Se, SfA, SgB	Poor	Fair	Good	Good
For Pewamo part of SfA and SgB, see Pewamo series; for Metea part of SgB, see Metea series.				
Shoals: ShB	Poor	Fair	Fair	Good
Sloan: So	Poor	Poor	Poor	Poor
Spinks:				
SpB	Poor	Fair	Good	Good
SpC	Poor	Fair	Good	Good
St. Clair:				
StB	Good	Good	Good	Good
StC	Fair	Good	Good	Good
Tedrow: TeA, TfA	Poor	Fair	Good	Fair
Thetford: ThA	Poor	Fair	Good	Good
Wasepi: WaA, WeA	Good	Good	Good	Good

[1] Ratings for grain and seed crops are based on the premise that drainage is feasible.

devices in marshes or streams. Examples are muskrat marshes, waterflow feeding areas, wildlife ponds, and beaver ponds.

The ratings shown in table 4 apply to wildlife in general and not to a specific species. Present land use, existing vegetation, and the extent of artificial drainage provided are not considered because these factors are subject to change.

Openland wildlife are birds and mammals that normally frequent cropland, pastures, meadows, lawns, and areas overgrown with grasses, herbs, shrubs, and vines. Examples are bobwhite quail, ring-necked pheasant, meadowlark, field sparrow, killdeer, cottontail rabbit, red fox, and woodchuck.

Woodland wildlife are birds and mammals that normally frequent areas containing either hardwood or coniferous trees and shrubs or both. Examples are raccoon, white-tailed deer, woodcock, thrush, vireos, woodpecker, tree squirrel, gray fox, warbler, nuthatch, and owl.

Wetland wildlife are birds and mammals that normally frequent swampy, marshy, or open-water areas (fig. 17). Examples are duck, geese, heron, bittern, rail, kingfisher, crane, muskrat, and mink.

Wildlife plantings

Wildlife species, such as songbirds, cottontail rabbits, and tree squirrels, can thrive in backyards and neighborhood parks of the urban and suburban communities of Wayne County Area. Individual householders can do much to attract birds to their homes. A wildlife habitat can be designed and managed by providing the preferred food and cover plants adaptable to the various soils in Wayne County Area as shown in table 5.

Resident songbirds that may be attracted to yards and home grounds are the American goldfinch, cardinal, cedar waxwing, blue jay, black-capped chickadee, nuthatch, horned lark and downy woodpecker. Suitable food and cover for these birds consists of acorns, sunflowers, grapes, weeds, elderberry, highbush cranberry, autumn-olive, dogwood, and conifers.

Some birds common to Wayne County Area migrate north in spring and south in fall. The eastern bluebird, house wren, and purple martin are examples of birds that prefer birdhouses to raise their young. Other birds that are welcomed summer residents are the indigo bunting, hummingbird, eastern kingbird, swallow, catbird, brown thrasher, Baltimore oriole, scarlet tanager, and robin. Suitable food and cover for these species are apple, cherry, elderberry, mountainash, dogwood, honeysuckle, Russian-olive, and various berries. A favorite food of the hummingbird is the nectar of the columbine, delphinium, petunia, and trumpet creeper.

life habitat for kinds of wildlife—Continued

Suitability for elements of habitat—Continued			Suitability as habitat for—		
Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Fair	Poor	Good.
Fair	Good	Good	Fair	Fair	Good.
Good	Fair	Fair	Fair	Good	Fair.
Good	Fair	Fair	Fair	Good	Fair.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Fair	Fair	Fair	Fair	Fair	Fair.
Good	Fair	Fair	Fair	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.

Several colorful birds live in Wayne County only during the winter. Representative species are the brown creeper, golden-crowned kinglet, purple finch, slate-colored junco, and the tree sparrow. The preferred food and cover for these birds is sunflowers, wheat, seeds of various grasses, weeds, autumn-olive, corn, dogwood, conifers, and berries.

Various hardwood shrubs and vines useful to wildlife grow naturally in many different landscapes. These should be identified and utilized as the basis for additional or supplemental plantings to create a diversity of plant forms, food producers, and shelter plants where needed. Among them are staghorn sumac, common elderberry, juneberry, blackberry, American bittersweet, Virginia creeper, raspberry, common winterberry, red-osier dogwood, American hazelnut, hawthorn, wild grape, apple from old abandoned orchards, alder, American mountainash, aromatic wintergreen, and wild plum.

Creating a conservation planned landscape through the intermingling of various plant species, sizes, and shapes can be esthetically pleasing and of value to many species of wildlife.

Engineering [5]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building drainage systems, and systems for disposing of sewage. Among the soil properties most important to engineers are permeability, shear strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to water table, flood hazard, and relief.

The information in this section can be used to—

1. Make studies of soil and land use that aid in selecting and developing industrial, commercial, residential, and recreational sites.
2. Make estimates of engineering properties for use in planning farm drainage structures, dams, and other structures for conserving soil and water; in locating suitable routes for underground conduits and cables; and in locating sites for sewage disposal fields.
3. Make preliminary evaluations of soil conditions that will aid in selecting locations for highways, airports, pipelines, and sewage disposal fields, and in planning detailed surveys of the soils at the selected locations.
4. Locate sources of sand, gravel, and other material for use in construction.
5. Correlate pavement performance with the soil mapping units and thus develop information that

[5] KEITH I. BAKEMAN, civil engineer, Soil Conservation Service, helped prepare this section.

Figure 17.—Marsh in southeastern Wayne County provides feeding and breeding areas for wetland wildlife.

will be useful in designing and maintaining the pavements.

6. Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
7. Determine suitability of soils for movement of vehicles and construction equipment.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

It should be emphasized that the estimated soil properties and engineering interpretations made in this soil survey are not a substitute for an engineering soils investigation at a site before it is selected for a specific engineering work. The estimates reported here are generally to a depth of about 5 feet and normally do not apply to greater depth.

The mapping units shown on the maps in this survey may include small areas of different soil material. These included areas can be as much as 2 acres in size. They are too small to be mapped separately and generally are not significant to the farming in the area, but they can be important in engineering planning.

Information of value in planning engineering work is given throughout the text, particularly in the sections "Descriptions of the Soils" and "Formation and Classification of the Soils."

Some of the terms in soil science may be unfamiliar to the engineer; and some words, such as "soil," "clay," "silt," and "sand," have special meanings in soil science. These and other special terms used in the soil survey are defined in the Glossary at the back of this survey. Most of the information about engineering is given in tables 6, 7, and 8.

Engineering classification systems

Most highway engineers classify soil material in accordance with the system approved by the American Association of State Highway and Transportation Officials *(1)*. In this system soil material is classified in seven principal groups. The groups range from A-1 (gravelly soils having high bearing capacity, the best soils for subgrade) to A-7 (clayey soils having low strength when wet, the poorest soils for subgrade).

Some engineers prefer to use the Unified soil classification system *(8)*. In this system soil material is identified according to texture, plasticity, and performance as construction material. It is identified as coarse grained (GW, GP, GM, GC, SW, SP, SM, and SC), fine grained (ML, CL, OL, MH, CH, and OH), and highly organic (Pt).

Estimated engineering properties

In table 6 the soil series and the symbols for most mapping units are listed and estimates of soil properties significant in engineering are listed. The estimated properties are those of the representative soil. If test data are available, that information is used. If no test data are available, the estimates shown are based on comparisons of the soils in Wayne County Area with similar soils tested in other counties.

Depth to the seasonal high water table is the maximum height to which the water table rises during the year. The estimates are for soil material that has not been artificially drained. In general, the information in the table applies to a depth of 5 feet or less. Depth from the surface normally is given only for the major horizons. Other horizons are listed if they have engineering properties that significantly differ from those in adjacent horizons.

The estimated classification according to the textural classification of the U.S. Department of Agriculture and according to the AASHTO and Unified classification systems is given for each important layer. The figures showing the percentage of material passing through the 4, 10, 40, and 200 sieves are rounded off to the nearest 5 percent. The percentage passing the 200 sieve approximates the combined amount of silt and clay in the soil. Content of cobbles greater than 3 inches in size is estimated for each major horizon on the basis of weight percentages. The estimates are determined largely by visual observations of volume percentage in the field and converted by formula to weight percentage.

Liquid limit and plasticity index pertain to the effect of water on the strength and consistence of soil material. The plastic limit is the moisture content at which the soil material changes from the semisolid to the plastic state. The liquid limit is the moisture content at which soil material changes from the plastic to the liquid state. 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.

In the column "Permeability" are estimates of the rate at which water moves downward through undisturbed soil material. The estimates are based mainly on texture, structure, and consistence of the soils. The estimates 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 plants.

Reaction is the range in acidity or alkalinity of soil, expressed in pH values. The pH value and equivalent verbal descriptions of reaction are explained in the Glossary.

Shrink-swell potential is the change in volume of the soil that results from a change in the moisture content. It indicates the extent to which the soil shrinks as it dries out and swells when it becomes wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil.

Corrosion is the potential soil-induced chemical that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosion of concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. A rating of *low* indicates a low probability of soil-induced corrosion damage, and a rating of *high* a high probability of damage. If the rating is *high*, protective measures are needed for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations

The estimated interpretations in tables 7 and 8 are based on the engineering properties of soils shown in table 6, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers *(2)* and soil scientists with the soils of Wayne County Area. In tables 7 and 8, ratings summarize the limitations or the suitability of the soils for all the listed purposes.

Soil limitations are indicated by the ratings *slight*, *moderate*, and *severe*. *Slight* indicates that soil properties are generally favorable for the rated use and limitations are minor and easily overcome. *Moderate* indicates that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* indicates soil properties so unfavorable and so difficult to correct or overcome that they require major soil reclamation, special design, or intensive maintenance.

Soil suitability is expressed as *good*, *fair*, and *poor*, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations for some of the columns in table 7.

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 6 feet is evaluated. Soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Soil properties that affect absorption are permeability, depth to water table, and susceptibility to flooding. Slope is a soil property that affects layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough

TABLE 5.—*Suitable shrubs, trees, and vines for wildlife plantings*

[No estimates for Cut and fill land (Cu), Made land (Ma), and Marsh (Mb). Material too variable. Dashes indicate that plantings are not suited to, or do not ordinarily grow on, the soil]

Soil series and map symbol	Sun or shade plantings	Sun plantings	Sun or light shade plantings
Belleville: Ba			Gray dogwood, silky dogwood, Tatarian honeysuckle.
Blount: BbB, BcA	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, mountainash, wild grape, wild plum.	Gray dogwood, silky dogwood, Tatarian honeysuckle.
Boyer: BnB, BnC	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, crabapple, mountainash, multiflora rose, Russian-olive, sunflower, wild grape, wild plum.	Bittersweet, gray dogwood, silky dogwood, Tatarian honeysuckle.
Cohoctah: Cc			
Corunna: Co			Gray dogwood, silky dogwood, Tatarian honeysuckle.
Edwards: Ed			
Gilford: Gf			Gray dogwood, silky dogwood, Tatarian honeysuckle.
Granby: Gr			Gray dogwood, silky dogwood, Tatarian honeysuckle.
Houghton: Hn			
Hoytville: Ho			Gray dogwood, silky dogwood, Tatarian honeysuckle.
Kibbie: KnA	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, mountainash, wild grape, wild plum.	Gray dogwood, silky dogwood, Tatarian honeysuckle.
Metamora: MeA, MfA	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, mountainash, wild grape, wild plum.	Gray dogwood, silky dogwood, Tatarian honeysuckle.
Metea: MhB	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, crabapple, mountainash, multiflora rose, Russian-olive, sunflower.	Bittersweet, gray dogwood, silky dogwood, Tatarian honeysuckle.
Morley: MoB, MoC, MoD	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, crabapple, mountainash, multiflora rose, Russian-olive, sunflower, wild grape, wild plum.	Bittersweet, gray dogwood, silky dogwood, Tatarian honeysuckle.
Nappanee: NaB	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, mountainash, wild grape, wild plum.	Gray dogwood, silky dogwood, Tatarian honeysuckle.
Oakville: OaB	Autumn-olive, cherry, eastern redcedar, hawthorn.	Mountainash, Russian-olive	Bittersweet, gray dogwood, silky dogwood, Tatarian honeysuckle.
Owosso: OwB, OwC	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, crabapple, mountainash, multiflora rose, Russian-olive, sunflower, wild grape, wild plum.	Bittersweet, gray dogwood, silky dogwood, Tatarian honeysuckle.
Pella: Pc			Gray dogwood, silky dogwood, Tatarian honeysuckle.

TABLE 5.—*Suitable shrubs, trees, and vines for wildlife plantings*—Continued

Soil series and map symbol	Sun or shade plantings	Sun plantings	Sun or light shade plantings
Pewamo: Pe			Gray dogwood, silky dogwood, Tatarian honeysuckle.
Selfridge: Se, SfA, SgB	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, mountainash	Gray dogwood, silky dogwood, Tatarian honeysuckle.
Shoals: ShB	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, mountainash, wild grape, wild plum.	Gray dogwood, silky dogwood, Tatarian honeysuckle.
Sloan: So			
Spinks: SpB, SpC	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, crabapple, mountainash, multiflora rose, Russian-olive, sunflower, wild grape, wild plum.	Bittersweet, gray dogwood, silky dogwood, Tatarian honeysuckle.
St. Clair: StB, StC	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, crabapple, mountainash, multiflora rose, Russian-olive, sunflower, wild grape, wild plum.	Bittersweet, gray dogwood, silky dogwood, Tatarian honeysuckle.
Tedrow: TeA, TfA	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, mountainash	Gray dogwood, silky dogwood, Tatarian honeysuckle.
Thetford: ThA	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, mountainash, wild grape, wild plum.	Gray dogwood, silky dogwood, Tatarian honeysuckle.
Wasepi: WaA, WeA	Arrowwood, autumn-olive, cherry, eastern redcedar, elderberry, firethorn, hawthorn, highbush cranberry, holly, nannyberry.	Cotoneaster, mountainash, wild grape, wild plum.	Gray dogwood, silky dogwood, Tatarian honeysuckle.

for bacteria to decompose the solids. A lagoon has a nearly level floor and has sides, or embankments, of compacted soil material. It is assumed that the embankment is compacted to medium density and that the pond is protected from flooding. Soil properties considered are those that affect the pond floor and the embankment. Soil properties that affect the pond floor are permeability, organic matter, and slope. Soil properties that affect the embankment are the engineering properties of the embankment material, as interpreted from the Unified Soil Classification, and the number 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, for example, 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 large stones, no flooding, and no high water table.

Dwellings, as rated in table 7, are no more than three stories high and are supported by foundation footings 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, and content of stones and rocks.

Local roads and streets, as rated in table 7, 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 of 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 the load support-

TABLE 6.—*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, which to other series in the first column of this table. No estimates for Cut and fill land (Cu), Made land (Ma), and Marsh (Mb). Material more than; the symbol < means less than]

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
				Unified	AASHTO	
	Feet	*Inches*				
Belleville: Ba	0–1	0–11	Loamy fine sand	SM	A–2	------
		11–30	Fine sand	SM	A–2	------
		30–60	Clay loam, silty clay loam.	CL	A–6, or A–7	------
* Blount: BbB, BcA	1–2	0–9	Loam	ML	A–4	0–5
For Pewamo part of BcA, see Pewamo series.		9–27	Silty clay loam, clay	CL, CH	A–6, A–7	0–5
		27–60	Silty clay loam	CL	A–6	0–5
Boyer: BnB, BnC	>5	0–18	Loamy sand	SM	A–2	------
		18–26	Sandy clay loam	SC	A–2 or A–6	------
		26–29	Gravelly loamy sand	SM	A–2	------
		29–60	Gravelly sand	SP, SP–SM	A–1 or A–3	------
Cohoctah: Cc	0–1	0–22	Fine sandy loam	SM or ML	A–4	------
Frequently flooded.		22–45	Loamy fine sand and sand.	SM	A–2	------
		45–53	Fine sandy loam	SM	A–4	------
		53–60	Sand and gravel	SP or SP–SM	A–1 or A–3	------
Corunna: Co	0–1.5	0–25	Fine sandy loam and sandy loam.	SM or ML	A–4	------
		25–34	Loamy sand	SM	A–2	------
		34–60	Silty clay loam	CL	A–6	------
Edwards: Ed	0–0.5	0–27	Muck (sapric)	Pt	------	------
		27–60	Marl	------	------	------
Gilford: Gf	0–1	0–25	Sandy loam	SM	A–2	------
		25–38	Loamy sand	SM	A–2	------
		38–60	Gravelly sand	SP or SP–SM	A–3 or A–1	------
Granby: Gr	0–1	0–11	Loamy fine sand	SM	A–2	------
		11–60	Fine sand	SP	A–3	------
Houghton: Hn	0–1	0–60	Muck (sapric)	Pt	------	------
Hoytville: Ho	0–0.5	0–9	Silty clay loam	CL	A–6 or A–7	------
		9–38	Clay and silty clay	CH	A–7	------
		38–60	Clay	CH	A–7	------
Kibbie: KnA	1.5–2	0–9	Fine sandy loam	ML, SM	A–4	------
		9–29	Heavy silt loam and silty clay loam.	CL	A–6	------
		29–38	Silt loam	ML	A–4	------
		38–60	Stratified silt, very fine sand, and silt loam.	ML and SM	A–4	------
*Metamora: MeA, MfA	1.0–2	0–26	Sandy loam and heavy sandy loam.	SM or SM–SC	A–2 or A–4	0–5
For Pewamo part of MfA, see Pewamo series.		26–60	Silty clay loam	CL	A–6	0–5
Metea: MhB	>4–6	0–33	Loamy sand and fine sand.	SM	A–2	------
		33–60	Silty clay loam and clay loam.	CL	A–6	------
Morley: MoB, MoC, MoD	>3	0–8	Loam	ML or CL	A–4 or A–6	0–5
		8–13	Clay loam	CL	A–6	0–5
		13–26	Clay	CH or CL	A–7	0–5
		26–60	Clay loam	CL	A–6	0–5
Nappanee: NaB	1–2	0–7	Silt loam	ML	A–4	------
		7–24	Clay	CH	A–7	------
		24–60	Clay	CH	A–7	0–5

significant in engineering

may have different properties and interpretations. For this reason the reader should follow carefully the instructions for referring too variable. Absence of data indicates that the soil is too variable to be rated or that no estimate was made. The symbol > means

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion to—	
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*			
100	95–100	70–85	20–35	0–20	NP–4	6.0–20.0	0.10–0.12	7.4–7.8	Low	High	Low.
100	95–100	70–85	15–30	0–20	NP–4	6.0–20.0	0.06–0.10	[2] 7.4–7.8	Low	High	Low.
100	90–100	90–100	70–90	25–50	11–22	0.2–0.6	0.14–0.20	[2] 7.9–8.4	Moderate	High	Low.
95–100	90–100	85–95	60–70	18–38	4–9	0.6–2.0	0.20–0.22	6.1–6.5	Low	High	Moderate.
95–100	90–100	90–95	85–95	29–51	15–26	0.2–0.6	0.11–0.19	5.6–7.8	High	High	High.
90–95	85–95	80–95	80–90	28–36	11–18	0.2–0.6	0.18–0.20	[2] 7.4–7.8	Moderate	High	Low.
95–100	70–85	45–70	15–30	------	NP	6.0–20.0	0.10–0.12	6.6–7.3	Low	Low	Moderate.
95–100	70–85	65–85	25–45	25–35	11–15	2.0–6.0	0.16–0.18	6.6–7.3	Low	Low	Moderate.
80–90	70–90	40–65	15–20	------	NP	6.0–20.0	0.08–0.10	7.4–7.8	Low	Low	Low.
55–80	50–70	30–55	0–10	------	NP	>20.0	0.02–0.04	[2] 7.4–7.8	Low	Low	Low.
100	100	75–85	40–55	18–30	4–9	2.0–6.0	0.16–0.18	7.4–7.8	Low	High	Low.
100	100	50–75	15–30	------	NP	6.0–20.0	0.10–0.12	[2] 7.4–7.8	Low	High	Low.
100	95–100	70–85	35–50	18–30	4–9	2.0–6.0	0.16–0.18	[2] 7.4–7.8	Low	High	Low.
55–80	50–70	30–55	0–10	------	NP	>20.0	0.02–0.04	[2] 7.4–7.8	Low	High	Low.
100	95–100	70–85	40–55	15–29	2–8	0.6–2.0	0.16–0.18	6.6–7.3	Low	High	Low.
95–100	95–100	50–70	15–25	0–15	NP–4	6.0–20.0	0.08–0.10	[2] 7.4–7.8	Low	High	Low.
100	95–100	90–100	85–90	27–37	11–16	0.2–0.6	0.18–0.20	[2] 7.4–7.8	Moderate	High	Low.
------	------	------	------	------	------	6.0–10.0	0.35–0.45	6.6–7.8	High	High	Low.
100	95–100	80–90	60–80	------	------	------	------	[2] 7.4–7.8	High	High	Low.
90–100	85–95	55–60	20–30	20–29	2–7	2.0–6.0	0.12–0.14	5.6–6.5	Low	High	Moderate.
85–95	80–95	45–70	10–20	------	NP	2.0–6.0	0.08–0.10	6.6–7.3	Low	High	Low.
85–100	75–95	40–60	3–10	------	NP	6.0–20.0	0.05–0.07	[2] 7.4–7.8	Low	Moderate	Low.
100	100	50–75	15–30	------	NP	6.0–20.0	0.10–0.12	6.6–7.3	Low	High	Low.
100	100	60–70	0–5	------	NP	6.0–20.0	0.06–0.08	6.6–7.3	Low	High	Low.
------	------	------	------	------	----	6.0–10.0	0.35–0.45	6.6–7.8	High	High	Low.
100	100	90–100	85–95	36–50	15–25	0.6–2.0	0.14–0.17	6.6–7.3	Moderate	High	Low.
100	100	90–100	85–95	50–66	22–40	0.2–0.6	0.11–0.15	6.6–7.8	High	High	Low.
100	100	90–100	85–95	52–60	29–34	0.06–0.2	0.10–0.14	[2] 7.4–7.8	High	High	Low.
100	100	75–85	40–55	18–38	4–9	0.6–2.0	0.16–0.18	6.6–7.3	Low	High	Moderate.
100	100	95–100	80–90	29–40	10–20	0.6–2.0	0.18–0.22	6.6–7.3	Low	High	Moderate.
100	100	90–100	70–90	18–37	4–9	0.6–2.0	0.20–0.22	[2] 6.6–7.3	Low	High	Moderate.
100	100	75–90	40–80	15–30	NP–4	0.6–2.0	0.16–0.18	7.4–7.8	Low	High	Low.
95–100	95–100	65–80	25–45	12–29	NP–7	2.0–6.0	0.13–0.15	6.1–7.3	Low	Moderate	Moderate.
95–100	95–100	90–100	75–85	27–36	11–18	0.2–0.6	0.16–0.18	[2] 7.4–7.8	Moderate	High	Low.
95–100	95–100	45–70	10–25	------	NP	>20	0.10–0.12	5.6–7.3	Low	Low	Moderate.
95–100	95–100	90–95	80–90	27–36	11–18	0.6–2.0	0.15–0.19	[2] 6.6–7.8	Moderate	Moderate	Low.
95–100	90–100	85–95	60–75	23–38	4–14	0.6–2.0	0.20–0.22	6.6–7.3	Low	Moderate	Low.
95–100	90–100	85–95	65–80	29–40	12–18	0.2–0.6	0.17–0.19	7.4–7.8	Moderate	Moderate	Moderate.
95–100	90–100	90–100	80–90	45–55	20–30	0.2–0.6	0.11–0.13	7.4–7.8	Moderate	High	Moderate.
95–100	90–100	90–100	70–80	32–36	13–18	0.2–0.6	0.14–0.16	[2] 7.4–7.8	Moderate	Moderate	Low.
95–100	95–100	85–100	65–80	25–37	5–9	0.6–2.0	0.22–0.24	6.1–6.5	Low	Moderate	Low.
95–100	95–100	85–100	70–95	50–70	22–42	<0.6	0.10–0.12	6.6–7.8	High	High	Low.
95–100	95–100	85–100	70–95	50–60	29–34	<0.06	0.08–0.10	[2] 7.4–7.8	High	High	Low.

TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
				Unified	AASHTO	
	Feet	*Inches*				
Oakville: OaB	>6	0–60	Fine sand	SM	A–2	
* Owosso: OwB, OwC	4–>6	0–38	Sandy loam	SM	A–2 or A–4	0–5
		38–60	Silty clay loam	CL	A–6	0–5
For Morley part of OwB and OwC, see Morley series.						
Pella: Pc	0–1.5	0–16	Silt loam	ML	A–4	
		16–26	Heavy silt loam	ML	A–4	
		26–60	Stratified silty clay loam, silt loam, and silt.	ML	A–4	
Pewamo: Pe	0–1.5	0–10	Loam	ML	A–4	
		10–36	Silty clay loam	CL	A–6 or A–7	
		36–60	Silty clay loam	CL	A–6	
* Selfridge: Se, SfA, SgB	1.0–2	0–24	Loamy sand and sand	SM	A–2	
		24–29	Sandy loam	SM, SC	A–2 or A–4	
For Metea part of SgB, see Metea series; for Pewamo part of SfA and SgB, see Pewamo series.		29–60	Clay loam	CL	A–6	
Shoals: ShB	1–2	0–16	Silt loam	ML	A–4	
		16–55	Heavy silt loam and silty silty clay loam.	CL	A–6	
		55–60	Loam	ML or CL	A–4	
Sloan: So	0	0–20	Silt loam	ML	A–4	
Undrained.		20–55	Silty clay loam	CL	A–6	
		55–60	Sandy loam	SM	A–4	
Spinks: SpB, SpC	>6	0–10	Loamy sand	SM	A–2	
		10–18	Fine sand	SP–SM or SM	A–2 or A–3	
		18–55	Fine sand and loamy fine sand.	SM	A–2	
		55–60	Fine sand	SP–SM or SM	A–2 or A–3	
St. Clair: StB, StC	2–3	0–10	Clay loam	CL	A–4, A–6	
		10–17	Clay	CH	A–7	
		17–60	Clay	CH	A–7	
Tedrow:						
TeA	0.5–1.5	0–9	Loamy fine sand	SM	A–2	
		9–60	Fine sand	SM	A–2	
TfA	1–2.5	0–23	Loamy fine sand	SM	A–2	
Loamy substratum.		23–47	Sand	SP or SP–SM	A–2 or A–3	
		47–60	Silty clay loam	CL or CH	A–7	
Thetford: ThA	1–2	0–10	Loamy sand	SM	A–2	
		10–24	Fine sand	SM	A–2	
		24–43	Fine sand and loamy sand.	SM	A–2	
		43–60	Fine sand	SM	A–2	
Wasepi:						
WaA	1–2	0–15	Loamy sand	SM	A–2	
		15–26	Sandy loam	SM	A–2	
		26–60	Gravelly sand	SP or SP–SM	A–1 or A–3	
WeA	1–2.5	0–14	Loamy sand	SM	A–2	
Loamy substratum.		14–37	Sandy loam and loamy sand.	SM	A–2	
		37–50	Gravelly sand	SP or SP–SM	A–1, A–2, or A–3	
		50–60	Silty clay loam	CL	A–6	

[1] NP means nonplastic.

significant in engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion to—	
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*			
100	100	70–85	20–35	------	NP	>20.0	0.07–0.09	5.6–6.5	Low	Low	Moderate.
95–100	90–100	55–70	25–40	12–29	2–7	2.0–6.0	0.13–0.15	5.6–6.5	Low	Low	Moderate.
95–100	90–95	85–95	80–90	27–36	11–18	0.2–0.6	0.18–0.20	[2] 6.6–7.8	Moderate	Moderate	Low.
100	100	90–100	70–90	25–40	5–9	0.6–2.0	0.22–0.24	7.4–7.8	Low	High	Low.
100	100	95–100	70–90	15–30	6–10	0.6–2.0	0.20–0.22	7.4–7.8	Low	High	Low.
100	95–100	90–100	65–95	17–27	3–10	0.6–2.0	0.18–0.22	[2] 7.4–7.8	Low	High	Low.
95–100	95–100	85–95	60–75	23–37	4–9	0.6–2.0	0.20–0.22	6.1–6.5	Low	High	Low.
95–100	95–100	95–100	85–95	36–48	15–25	0.2–0.6	0.18–0.20	6.1–7.3	Moderate	High	Low.
95–100	95–100	95–100	85–95	32–40	14–18	0.2–0.6	0.16–0.18	[2] 7.4–7.8	Moderate	High	Low.
100	95–100	55–75	15–30	>20	NP–4	6.0–20.0	0.08–0.12	6.1–7.3	Low	Low	Moderate.
100	95–100	65–75	30–40	15–30	2–10	6.0–20.0	0.16–0.18	6.6–7.3	Low	Moderate	Moderate.
100	95–100	90–100	70–80	27–36	11–18	0.2–0.6	0.14–0.16	[2] 7.4–7.8	Moderate	High	Low.
100	100	85–95	60–75	25–36	6–9	0.6–2.0	0.22–0.24	6.6–7.3	Low	Moderate	Low.
100	100	90–100	85–95	30–40	12–18	0.6–2.0	0.18–0.22	7.4–7.8	Low	High	Low.
100	90–100	85–95	60–75	17–27	3–8	0.6–2.0	0.17–0.19	[2] 7.4–7.8	Low	High	Low.
100	100	90–100	70–90	30–35	8–10	0.6–2.0	0.22–0.24	7.4–7.8	Low	High	Low.
100	100	95–100	85–95	30–40	12–18	0.6–2.0	0.15–0.19	7.4–7.8	Moderate	High	Low.
100	100	60–70	35–45	15–25	3–8	0.6–2.0	0.11–0.13	6.6–7.3	Low	High	Low.
100	100	50–75	15–30	------	NP	6.0–20.0	0.08–0.10	6.6–7.3	Low	Low	Low.
100	100	55–70	5–20	------	NP	6.0–20.0	0.06–0.08	6.6–7.3	Low	Low	Low.
100	100	60–75	10–30	------	NP	6.0–20.0	0.04–0.08	7.4–7.8	Low	Low	Low.
100	100	65–80	10–25	------	NP	6.0–20.0	0.04–0.06	7.4–7.8	Low	Low	Low.
95–100	95–100	90–100	70–80	27–37	9–16	0.2–0.6	0.17–0.19	6.1–7.3	Moderate	Moderate	Moderate.
95–100	95–100	90–100	75–95	50–70	22–42	<0.06	0.10–0.12	6.6–7.3	High	High	Moderate.
95–100	95–100	90–100	75–95	50–60	29–34	<0.06	0.09–0.11	[2] 6.6–7.8	High	High	Low.
100	100	60–75	20–30	------	NP	6.0–20.0	0.10–0.12	5.6–6.0	Low	Low	Moderate.
100	100	65–80	20–35	------	NP	6.0–20.0	0.05–0.07	5.6–7.3	Low	Low	Moderate.
100	100	50–75	15–30	------	NP	6.0–20.0	0.10–0.12	5.6–6.5	Low	Low	Moderate.
100	100	50–70	5–15	------	NP	6.0–20.0	0.06–0.08	[2] 6.6–7.8	Low	Low	Low.
100	100	95–100	80–90	45–55	20–30	0.2–0.6	0.18–0.20	[2] 7.4–7.8	Moderate	High	Low.
100	95–100	70–85	25–35	------	NP	2.0–6.0	0.10–0.12	6.6–7.3	Low	Low	Moderate.
100	95–100	65–75	20–30	------	NP	6.0–20.0	0.08–0.10	6.1–6.5	Low	Low	Moderate.
100	95–100	60–75	20–30	------	NP	2.0–6.0	0.08–0.11	6.1–7.3	Low	Low	Moderate.
100	95–100	65–75	20–30	------	NP	6.0–20.0	0.06–0.08	7.4–7.8	Low	Low	Low.
95–100	85–95	50–65	15–25	------	NP	6.0–20.0	0.10–0.12	5.6–6.5	Low	Moderate	Moderate.
95–100	75–90	55–75	20–30	15–28	NP–4	2.0–6.0	0.12–0.14	6.1–6.5	Low	Moderate	Moderate.
75–95	60–95	35–55	0–10	------	NP	>20.0	0.02–0.04	[2] 7.4–7.8	Low	Moderate	Low.
95–100	90–95	60–90	15–25	------	NP	6.0–20.0	0.10–0.12	6.6–7.3	Low	Moderate	Low.
95–100	90–95	55–65	25–35	<20	NP–7	2.0–6.0	0.11–0.13	7.4–7.8	Low	Moderate	Low.
55–75	45–90	35–55	0–10	------	NP	>20.0	0.02–0.04	[2] 7.4–7.8	Low	Moderate	Low.
100	95–100	95–100	80–90	27–36	11–18	0.2–0.6	0.18–0.20	[2] 7.4–7.8	Moderate	High	Low.

[2] Effervescent.

TABLE 7.—*Limitations of the soils*

[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, which may series in the first column of this table. No estimates for Cut and fill land (Cu), Made land (Ma), and Marsh (Mb). Material too

Soil series and map symbols	Degree and kind of limitation for—Continued			
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements
Belleville: Ba	Severe: percs slowly; wetness; floods.	Severe: wetness; seepage.	Severe: wetness; floods; cutbanks cave.	Severe: wetness; frost action; floods.
* Blount:				
BbB	Severe: percs slowly; wetness.	Moderate: slope	Severe: wetness	Severe: wetness; frost action.
BcA For Pewamo part, see Pewamo series.	Severe: percs slowly; wetness.	Slight	Severe: wetness	Severe: wetness; frost action.
Boyer:				
BnB	Slight[1]	Severe: seepage	Severe: cutbanks cave.	Slight
BnC	Moderate:[1] slope	Severe: seepage; slope.	Severe: cutbanks cave.	Moderate: slope
Cohoctah: Cc	Severe: floods; wetness.	Severe: floods; wetness; seepage.	Severe: wetness; floods; cutbanks cave.	Severe: wetness; floods; frost action.
Corunna: Co	Severe: wetness; percs slowly; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; frost action; floods.
Edwards: Ed	Severe: wetness; floods.	Severe: wetness; seepage; excess humus; floods.	Severe: wetness; excess humus; floods; cutbanks cave.	Severe: wetness; floods; frost action; low strength; excess humus.
Gilford: Gf	Severe:[1] wetness; floods.	Severe: wetness; seepage.	Severe: wetness; floods; cutbanks cave.	Severe: wetness; frost action; floods.
Granby: Gr	Severe:[1] wetness; floods.	Severe: wetness; floods.	Severe: wetness; floods; cutbanks cave.	Severe: wetness; floods.
Houghton: Hn	Severe: wetness; floods.	Severe: wetness; seepage; excess humus.	Severe: wetness; floods; cutbanks cave; excess humus.	Severe: wetness; floods; frost action; low strength; excess humus.
Hoytville: Ho	Severe: wetness; percs slowly; floods.	Slight	Severe: wetness; too clayey; floods.	Severe: wetness; frost action; shrink swell; floods.
Kibbie: KnA	Severe: wetness	Severe: wetness	Severe: wetness; cutbanks cave.	Severe: wetness; frost action; low strength.
*Metamora: MeA, MfA For Pewamo part of MfA, see Pewamo series.	Severe: wetness; percs slowly.	Severe: wetness	Severe: wetness	Severe: frost action; wetness.
Metea: MhB	Moderate: percs slowly.	Moderate: too sandy; seepage; slope.	Slight	Moderate: frost action.
Morley:				
MoB	Severe: percs slowly.	Moderate: slope	Moderate: too clayey.	Moderate: shrink swell; frost action.
MoC	Severe: percs slowly.	Severe: slope	Moderate: too clayey; slope.	Moderate: shrink swell; frost action.

for land use planning

have different properties and interpretations. For this reason the reader should follow carefully the instructions for referring to other variable. Some terms in this table are explained in the glossary where they are identified by an asterisk]

Degree and kind of limitation for—Continued					Suitability as cover for landfill
Dwellings with basements	Small commercial buildings	Local roads and streets	Sanitary landfill [1]		
			Trench type	Area type	
Severe: wetness; frost action; floods.	Severe: wetness; frost action; floods.	Severe: wetness; frost action; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Poor: wetness.
Severe: wetness	Severe: wetness; frost action.	Severe: shrink swell; frost action.	Severe: wetness	Moderate: wetness.	Fair: too clayey.
Severe: wetness	Severe: wetness; frost action.	Severe: shrink swell; frost action.	Severe: wetness	Moderate: wetness.	Fair: too clayey.
Slight	Moderate: slope	Slight	Severe: seepage	Severe: [1] seepage	Fair: thin layer.
Moderate: slope	Severe: slope	Moderate: slope	Severe: seepage	Severe: [1] seepage	Fair: thin layer.
Severe: wetness; floods.	Severe: wetness; floods; frost action.	Severe: wetness; floods; frost action.	Severe: floods; wetness; seepage.	Severe: floods; wetness; seepage.	Poor: wetness.
Severe: wetness; frost action; floods.	Severe: wetness; frost action; floods.	Severe: wetness; frost action; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Poor: wetness.
Severe: wetness; floods; low strength.	Severe: wetness; floods; frost action; low strength; excess humus.	Severe: wetness; floods; excess humus; low strength; frost action.	Severe: wetness; floods; seepage; excess humus.	Severe: wetness; seepage; floods.	Poor: wetness; excess humus; hard to pack.
Severe: wetness; floods.	Severe: wetness; frost action; floods.	Severe: wetness; frost action; floods.	Severe: wetness; seepage; floods.	Severe: wetness; seepage; floods.	Poor: wetness; seepage; floods.
Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; seepage; floods.	Severe: wetness; seepage; floods.	Poor: wetness; too sandy; seepage; floods.
Severe: wetness; floods; low strength; excess humus.	Severe: wetness; floods; frost action; low strength; excess humus.	Severe: wetness; floods; excess humus; low strength; frost action.	Severe: wetness; floods; seepage; excess humus.	Severe: wetness; seepage; floods.	Poor: wetness; excess humus; hard to pack; seepage.
Severe: wetness; shrink swell; frost action; floods.	Severe: wetness; shrink swell; frost action; floods.	Severe: wetness; low strength; shrink swell; frost action; floods.	Severe: wetness; too clayey; floods.	Severe: wetness; floods.	Poor: wetness; too clayey; hard to pack; floods.
Severe: wetness; low strength.	Severe: wetness; frost action; low strength.	Severe: frost action; low strength.	Severe: wetness	Severe: wetness	Good.
Severe: wetness	Severe: frost action; wetness.	Severe: frost action.	Severe: wetness	Severe: wetness	Good.
Slight	Moderate: slope; frost action.	Moderate: frost action.	Slight	Slight	Fair: too sandy.
Moderate: shrink swell.	Moderate: shrink swell; frost action.	Moderate: shrink swell; frost action.	Slight	Slight	Fair: too clayey; hard to pack.
Moderate: shrink swell.	Severe: slope	Moderate: shrink swell; frost action.	Slight	Moderate: slope	Fair: too clayey; hard to pack.

TABLE 7.—*Limitations of the soils*

Soil series and map symbols	Degree and kind of limitation for—Continued			
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements
MoD	Severe: percs slowly; slope.	Severe: slope	Severe: slope	Severe: slope
Nappanee: NaB	Severe: percs slowly; wetness.	Moderate: slope	Severe: wetness; too clayey.	Severe: shrink swell; frost action; wetness.
Oakville: OaB	Slight [1]	Severe: seepage	Severe: cutbanks cave.	Slight
* Owosso:				
OwB	Severe: percs slowly.	Severe: seepage; slope.	Slight	Moderate: frost action.
OwC	Severe: percs slowly.	Severe: seepage; slope.	Moderate: slope	Moderate: slope; frost action.
For Morley part, see Morley series.				
Pella: Pc	Severe: wetness; floods.	Severe: wetness	Severe: wetness; cutbanks cave; floods.	Severe: wetness; floods; frost action; low strength.
Pewamo: Pe	Severe: wetness; floods; percs slowly.	Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; floods; frost action.
* Selfridge: Se, SfA, SgB	Severe: wetness; percs slowly.	Severe: seepage; wetness.	Severe: wetness; cutbanks cave.	Severe: wetness; frost action.
For Pewamo part of SfA and SgB, see Pewamo series; for Metea part of SgB, see Metea series.				
Shoals: ShB	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; frost action; wetness.
Sloan: So	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness; cutbanks cave.	Severe: floods; frost action; wetness.
Spinks:				
SpB	Slight [1]	Severe: seepage	Severe: cutbanks cave.	Slight
SpC	Moderate: slope	Severe: seepage; slope.	Severe: cutbanks cave.	Moderate: slope
St. Clair:				
StB	Severe: percs slowly.	Moderate: slope	Severe: too clayey.	Severe: shrink swell.
StC	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Severe: shrink swell.
Tedrow:				
TeA	Severe: [1] wetness	Severe: wetness; seepage.	Severe: wetness; cutbanks cave.	Severe: wetness
TfA	Severe: [1] wetness; percs slowly.	Severe: wetness; seepage.	Severe: wetness; cutbanks cave.	Severe: wetness
Thetford: ThA	Severe: [1] wetness	Severe: wetness; seepage.	Severe: wetness; cutbanks cave.	Severe: wetness
Wasepi:				
WaA	Severe: [1] wetness	Severe: wetness; seepage.	Severe: wetness; cutbanks cave.	Severe: wetness; frost action.
WeA	Severe: [1] wetness; percs slowly.	Severe: wetness; seepage.	Severe: wetness; cutbanks cave.	Severe: wetness; frost action.

[1] Onsite study is needed of the underlying strata, the water table, and the hazards of aquifer pollution and drainage into ground water in landfill more than 5 or 6 feet deep.

for land use planning—Continued

Degree and kind of limitation for—Continued					Suitability as cover for landfill
Dwellings with basements	Small commercial buildings	Local roads and streets	Sanitary landfill [1]		
			Trench type	Area type	
Severe: slope	Severe: slope	Severe: shrink swell; slope.	Moderate: slope	Severe: slope	Poor: too clayey; hard to pack; slope.
Severe: shrink swell; wetness.	Severe: wetness; shrink swell; frost action.	Severe: shrink swell; frost action; low strength.	Severe: too clayey; wetness.	Severe: wetness	Poor: too clayey; hard to pack.
Slight	Slight	Slight	Severe: [1] too sandy; seepage.	Severe: [1] seepage	Poor: too sandy; area reclaim.
Slight	Moderate: slope; frost action.	Moderate: frost action.	Slight	Slight	Good.
Moderate: slope	Severe: slope	Moderate: slope; frost action.	Slight	Moderate: slope	Good.
Severe: wetness; floods; low strength.	Severe: wetness; floods; frost action; low strength.	Severe: wetness; frost action; low strength; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Poor: wetness.
Severe: wetness; floods.	Severe: wetness; floods; frost action.	Severe: wetness; frost action; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Poor: wetness.
Severe: wetness	Severe: wetness; frost action.	Severe: wetness; frost action.	Severe: wetness	Moderate: wetness; seepage.	Poor: too sandy.
Severe: floods; wetness.	Severe: floods; frost action; wetness.	Severe: floods; frost action.	Severe: floods: wetness.	Severe: floods; wetness.	Good.
Severe: floods; wetness.	Severe: floods; frost action; wetness.	Severe: floods; frost action; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Poor: wetness.
Slight	Slight	Slight	Severe: [1] seepage; too sandy.	Severe: [1] seepage	Poor: too sandy; seepage; area reclaim.
Moderate: slope	Severe: slope	Moderate: slope	Severe: [1] seepage; too sandy.	Severe: [1] seepage	Poor: too sandy; seepage; area reclaim.
Severe: shrink swell.	Severe: shrink swell.	Severe: shrink swell; low strength.	Severe: too clayey.	Slight	Poor: too clayey.
Severe: shrink swell.	Severe: shrink swell.	Severe: shrink swell; low strength.	Severe: too clayey.	Moderate: slope	Poor: too clayey.
Severe: wetness	Severe: wetness	Moderate: wetness; frost action.	Severe: [1] seepage; wetness; too sandy.	Severe: [1] seepage; wetness.	Fair: too sandy; seepage.
Severe: wetness	Severe: wetness	Moderate: wetness; frost action.	Severe: [1] seepage; wetness.	Severe: [1] seepage; wetness.	Fair: too sandy; seepage.
Severe: wetness	Severe: wetness	Moderate: wetness; frost action.	Severe: [1] seepage; wetness; too sandy.	Severe: [1] seepage; wetness.	Fair: too sandy; seepage.
Severe: wetness	Severe: wetness; frost action.	Severe: frost action.	Severe: [1] seepage; wetness.	Severe: [1] seepage; wetness.	Fair: thin layer.
Severe: wetness	Severe: wetness; frost action.	Severe: frost action.	Severe: [1] seepage; wetness.	Severe: [1] seepage; wetness.	Fair: thin layer.

TABLE 8.—*Interpretations of the soils as a source of*

[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, which to other series in the first column of this table. No estimates for Cut and fill land (Cu), Made land (Ma), and Marsh (Mb). Material

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Gravel	Topsoil
Belleville: Ba	Poor: wetness; thin layer.	Poor: thin layer	Unsuited	Poor: too sandy; wetness.
* Blount: BbB	Poor: shrink swell; frost action.	Unsuited	Unsuited	Fair: thin layer
BcA For Pewamo part, see Pewamo series.	Poor: shrink swell; frost action.	Unsuited	Unsuited	Fair: thin layer
Boyer: BnB	Good	Good	Good	Poor: too sandy
BnC	Good	Good	Good	Poor: too sandy
Cohoctah: Cc	Poor: wetness; frost action.	Unsuited	Unsuited	Poor: wetness
Corunna: Co	Poor: wetness; frost action.	Unsuited	Unsuited	Poor: wetness
Edwards: Ed	Poor: frost action; excess humus; wetness.	Unsuited	Unsuited	Poor: wetness
Gilford: Gf	Poor: wetness; frost action.	Fair: excess fines.	Fair: excess fines.	Poor: wetness
Granby: Gr	Poor: wetness	Good	Unsuited	Poor: too sandy
Houghton: Hn	Poor: wetness; excess humus; frost action; low strength.	Unsuited	Unsuited	Poor: wetness
Houghton: Ho	Poor: wetness; shrink swell; low strength.	Unsuited	Unsuited	Poor: wetness
Kibbie: KnA	Poor: frost action; low strength.	Unsuited	Unsuited	Good
* Metamora: MeA, MfA For Pewamo part of MfA, see Pewamo series.	Poor: frost action	Unsuited	Unsuited	Good
Metea: MhB	Fair: thin layer; frost action.	Unsuited	Unsuited	Poor: too sandy
Morley: MoB	Poor: shrink-swell potential; too clayey.	Unsuited	Unsuited	Fair: thin layer
MoC	Poor: shrink-swell potential; too clayey.	Unsuited	Unsuited	Fair: thin layer; slope.
MoD	Poor: shrink-swell potential; too clayey; slope.	Unsuited	Unsuited	Poor: slope

construction material and for water management

may have different properties and interpretations. For this reason the reader should follow carefully the instructions for referring too variable. Some terms in this table are explained in the glossary where they are identified by an asterisk]

Soil features affecting—					
Pond reservoir area	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Seepage	Seepage; piping; low strength.	Wetness; poor outlets; floods.	Fast intake; wetness; floods.	Not needed	Not needed.
Favorable	Low strength; compressible.	Percs slowly	Wetness; slow intake; percs slowly.	Complex slopes	Wetness.
Favorable	Low strength; compressible.	Percs slowly	Wetness; slow intake; percs slowly.	Not needed	Wetness.
Seepage	Seepage	Not needed	Seepage; fast intake; soil blowing.	Complex slopes; soil blowing; too sandy.	Favorable.
Seepage; slope	Seepage	Not needed	Seepage; fast intake; soil blowing; slope.	Complex slopes; soil blowing; too sandy.	Slope.
Seepage	Low strength; piping; erodes easily.	Wetness; poor outlets; floods.	Wetness; floods	Not needed	Not needed.
Favorable	Favorable	Wetness; poor outlets; floods.	Wetness; floods	Not needed	Not needed.
Seepage	Compressible; hard to pack; low strength.	Wetness; floods; cutbanks cave; poor outlets.	Wetness; soil blowing; seepage; floods.	Not needed	Not needed.
Seepage	Seepage	Wetness; cutbanks cave; floods.	Wetness; seepage; floods.	Not needed	Not needed.
Seepage	Seepage; piping; erodes easily.	Wetness; floods; cutbanks cave.	Wetness; fast intake; seepage; soil blowing; floods.	Not needed	Not needed.
Seepage	Unstable fill; low strength; seepage.	Wetness; cutbanks cave; poor outlets; floods.	Wetness; soil blowing; fast intake; seepage; floods.	Not needed	Not needed.
Favorable	Low strength; hard to pack; compressible.	Wetness; percs slowly; floods.	Percs slowly; wetness; slow intake; floods.	Not needed	Wetness; percs slowly.
Seepage	Piping; erodes easily; unstable fill.	Wetness; cutbanks cave.	Wetness	Not needed	Erodes easily.
Favorable	Piping; compressible.	Wetness	Wetness; fast intake.	Not needed	Favorable.
Seepage	Favorable	Not needed	Fast intake; droughty.	Complex slopes; too sandy.	Droughty.
Favorable	Favorable	Not needed	Slow intake	Complex slopes; erodes easily.	Erodes easily.
Slope	Favorable	Not needed	Slow intake; slope	Complex slopes; erodes easily.	Erodes easily; slope.
Slope	Favorable	Not needed	Slow intake; slope	Complex slopes; erodes easily.	Erodes easily; slope.

TABLE 8.—*Interpretations of the soils as a source of*

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Gravel	Topsoil
Nappanee: NaB	Poor: shrink swell; frost action; low strength.	Unsuited	Unsuited	Fair: thin layer
Oakville: OaB	Good	Good	Unsuited	Poor: too sandy
* Owosso:				
OwB For Morley part, see Morley series.	Fair: frost action; low strength.	Unsuited	Unsuited	Good
OwC For Morley part, see Morley series.	Fair: frost action; low strength.	Unsuited	Unsuited	Fair: slope
Pella: Pc	Poor: wetness; frost action; low strength.	Unsuited	Unsuited	Poor: wetness
Pewamo: Pe	Poor: wetness; frost action.	Unsuited	Unsuited	Poor: wetness
* Selfridge: Se, SfA, SgB For Pewamo part of SfA and SgB, see Pewamo series; for Metea part of SgB, see Metea series.	Poor: frost action	Poor: excess fines	Unsuited	Poor: too sandy
Shoals: ShB	Poor: frost action	Unsuited	Unsuited	Good
Sloan: So	Poor: wetness; frost action.	Unsuited	Unsuited	Poor: wetness
Spinks:				
SpB	Good	Good	Unsuited	Poor: too sandy
SpC	Good	Good	Unsuited	Poor: too sandy
St. Clair:				
StB	Poor: shrink swell; low strength.	Unsuited	Unsuited	Fair: too clayey; thin layer.
StC	Poor: shrink swell; low strength.	Unsuited	Unsuited	Fair: too clayey; thin layer; slope.
Tedrow:				
TeA	Fair: wetness; area reclaim.	Fair: excess fines	Unsuited	Poor: too sandy
TfA	Fair: wetness; area reclaim.	Fair: excess fines	Unsuited	Poor: too sandy
Thetford: ThA	Fair: wetness	Fair: excess fines	Unsuited	Poor: too sandy
Wasepi:				
WaA	Poor: frost action	Good	Good	Poor: thin layer; too sandy.
WeA	Poor: frost action	Fair: excess fines	Poor: excess fines	Poor: thin layer; too sandy.

construction material and for water management—Continued

Soil features affecting—					
Pond reservoir area	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Favorable	Low strength; compressible; hard to pack; shrink swell.	Wetness; percs slowly.	Wetness; slow intake; percs slowly.	Wetness; percs slowly.	Wetness: percs slowly; erodes easily.
Seepage	Seepage; erodes easily; piping.	Not needed	Fast intake; soil blowing; seepage.	Soil blowing; too sandy; droughty.	Too sandy; droughty.
Seepage	Piping	Not needed	Complex slopes; erodes easily.	Complex slopes; erodes easily.	Erodes easily.
Seepage; slope	Piping	Not needed	Complex slopes; erodes easily.	Complex slopes; erodes easily.	Slope; erodes easily.
Seepage	Low strength; piping; erodes easily.	Cutbanks cave; wetness; floods.	Wetness; floods	Not needed	Wetness.
Favorable	Favorable	Wetness; floods; percs slowly.	Slow intake; wetness; percs slowly; floods.	Not needed	Wetness; percs slowly.
Favorable	Erodes easily; subject to piping.	Wetness; cutbanks cave.	Wetness; fast intake.	Not needed	Wetness.
Favorable	Piping; low strength.	Wetness; floods	Wetness; floods	Not needed	Not needed.
Favorable	Low strength; piping.	Wetness; poor outlets; floods.	Wetness; floods	Not needed	Not needed.
Seepage	Seepage; piping	Not needed	Droughty; fast intake; seepage; soil blowing.	Complex slopes; too sandy; soil blowing; droughty.	Droughty.
Seepage; slope	Seepage; piping	Not needed	Droughty; fast intake; seepage; soil blowing; slope.	Complex slopes; too sandy; soil blowing; droughty.	Droughty; slope.
Favorable	Low strength; hard to pack; shrink swell; compressible.	Not needed	Slow intake; percs slowly; erodes easily; complex slope.	Complex slope; percs slowly; erodes easily.	Percs slowly; erodes easily.
Slope	Low strength; hard to pack; shrink swell; compressible.	Not needed	Slow intake; percs slowly; erodes easily; complex slope.	Complex slope; percs slowly; erodes easily.	Percs slowly; erodes easily; slope.
Seepage	Seepage; piping; erodes easily.	Wetness; cutbanks cave.	Fast intake; wetness; seepage; droughty; soil blowing.	Not needed	Droughty.
Seepage	Seepage; piping; erodes easily.	Wetness; cutbanks cave.	Seepage; fast intake; droughty; wetness; soil blowing.	Not needed	Droughty.
Seepage	Seepage; piping	Wetness; cutbanks cave.	Fast intake; wetness; seepage; droughty.	Not needed	Droughty.
Seepage	Seepage; piping	Wetness; cutbanks cave.	Wetness; seepage	Not needed	Droughty.
Seepage	Seepage; piping	Wetness; cutbanks cave.	Wetness; seepage	Not needed	Droughty.

ing capacity, the 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, content of stones and rocks, and wetness affect the ease of excavation and the amount of cut and fill needed to achieve an even grade.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil 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 best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 7 apply only to a depth of about 6 feet. Therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are deeper. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but every site should be investigated before it is selected.

Suitability of a soil for cover is based on properties that affect ease of excavation and ease of spreading over fill during both wet and dry weather. Slope and thickness of suitable soil material are also important considerations. For area type landfills, soil for both daily and final cover must be imported. Therefore, areas of soils surrounding the sites generally should be evaluated.

Following are explanations for some of the columns in table 8.

Road fill is soil material used in embankments for roads. 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. They also reflect the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance on where to look for probable sources of these materials. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the material, and they do not indicate quality of the deposit.

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 soil material, as in preparing a seedbed; by natural fertility of the material, or the response of plants when fertilizer is applied; and by 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 at the area from which topsoil is removed.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable as pond reservoir areas have low seepage, which is related to permeability and depth to permeable material (fig. 18).

Embankments, dikes, and levees require soil material that is resistant to seepage and piping and that has favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are unfavorable factors.

Drainage of cropland 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 and in fragipans or other layers that restrict movement of water; amount of water 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 unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Grassed waterways require soil features that affect construction and maintenance of the waterways and growth of plants in them. Important features are fertility, available water capacity, rate of runoff, and susceptibility to erosion. Establishment of a good, dense sod that is resistant to erosion is needed for well constructed waterways.

Community Development

Community developers need soil information somewhat different from that needed by farmers. Land appraisers, realtors, city planners, builders, and others can use soil information to help determine what areas are suitable for houses and other small buildings. Soil information can also help determine what areas are best suited to recreation and open space. Homeowners can use information to help them in landscaping their property and protecting it against erosion.

Residences—Drainage, permeability, slope, water erosion, soil blowing, soil stability, shrink-swell potential, and frequency of flooding must be considered in evaluating the suitability of a site for an individual house or for a subdivision.

A house built on poorly drained or very poorly drained soils, such as Belleville, Granby, Gilford, Hoytville, and Pewamo soils, are likely to have wet basements unless some artificial drainage is provided. A high water table, even if only seasonal, keeps septic tank absorption fields from functioning properly. Information on drainage and the occurrence of a high water table can be found under the heading "Engineering."

Figure 18.—Farm pond in Pella silt loam.

Permeability is another property that affects the functioning of septic tank absorption fields. If the filter field is in rapidly or very rapidly permeable soils, such as Oakville and Spinks soils, the effluent may contaminate the water in shallow wells. Table 6 gives estimates of permeability rates for all the soils, and table 7 lists the limitations of soils as sites for septic tank absorption fields.

Organic soils, such as Edwards and Houghton soils, are not stable enough to be good foundations for houses and roads. Sandy soils, such as Tedrow and Oakville soils, have unstable cutbanks that cave and slough in any shallow excavation. Boyer, Oakville, and Spinks soils provide good foundations because they have a low shrink-swell potential and a fair to good bearing capacity. Soils having a high shrink-swell potential cause basement walls to crack and shift. Table 6 estimates shrink-swell potential for all the soils and can help identify the soils that have the least serious limitations for use as foundations.

Soils on bottom land are subject to flooding and consequently are not good choices for building sites. Shoals and Sloan soils are examples.

Erosion and the accumulation of sediment are hazards in housing developments if the soil is left bare for several weeks. Grading, paving, and compaction of soil during development can increase runoff from a built-up area two to ten times compared with the same area when it was farmed or wooded. Runoff concentrates in streets and gutters instead of flowing into natural waterways, which results in flooding and deposition of sediment in the lower areas. The hazard of erosion increases as slope increases. The sloping and strongly sloping Morley soils are particularly susceptible to erosion. Interpretations relating to the construction of diversions and grassed waterways and the installation of drainage facilities are listed in table 8. Following are measures that can be taken to control erosion in small residential tracts.

1. Build driveways, walks, and fences on the contour, or if this is not possible, straight across the slope.
2. Grade to make the surface level or gently sloping. The surface layer can be removed before grading and used later as topsoil.
3. Build diversions that intercept runoff and keep it from flowing over erodible areas.
4. Construct waterways or improve existing waterways in order to prevent gullying.

5. Drain seepage areas and waterlogged areas with tile or other facilities.

Soil blowing is a serious hazard in housing developments where the soil is left bare for several weeks. Grading removes the protective cover, and high winds can then cause the soil to blow and drift. If left unchecked, blowing sand can fill ditches and gutters and pile sand against houses to a depth of several inches. Blowing sand also reduces visibility on nearby streets.

Streets, driveways, sidewalks, and patios.—Soil properties that cause cracking and shifting of pavement are of special interest to homeowners and developers. Soils high in silt content, such as the Kibbie and Pella soils, are subject to frost heave. Concrete on such soils cracks readily unless the surface of the soil is first covered with sand and gravel. A high water table and a high content of clay can also cause pavement to crack and shift excessively. The Hoytville soil, for example, has these limitations. Organic soils, such as Edwards and Houghton soils, can cause pavement to crack and become uneven as a result of settling of the organic material after drainage. Table 6 shows estimates of the shrink-swell potential in all the soils of the county. Information in table 8 can be used to identify the soils that are unsuitable for streets, driveways, sidewalks, and patios.

Underground utility lines.—Water mains, gas pipelines, communication lines, and sewer lines that are buried in the ground may corrode and break unless protected against certain electrobiochemical reactions that result from inherent properties of the soils. These properties differ according to the nature of the soils. All metals corrode to some degree if buried, and some metals corrode more rapidly in some soils than in others. The corrosion potential depends on the physical, chemical, electrical, and biological properties of the soils, for example, oxygen concentration, concentration of anaerobic bacteria, and moisture content. The likelihood of corrosion is intensified by connecting dissimilar metals, by burying metal structures at varying depths, and by extending pipelines through different kinds of soils. Table 6 shows the corrosion potential to uncoated steel and to concrete.

If cast-iron pipe is used, stress caused by shrinking and swelling of the soils is an additional hazard. In soils that have a high shrink-swell potential, such as Hoytville and Nappanee soils, cast-iron pipes may break unless cushioned with sandy material.

Gardening and landscaping.—The ideal soils for yard and garden plants are those that have a deep root zone, a loamy texture, a balanced supply of plant nutrients, an adequate amount of organic matter, an adequate available water capacity, good drainage, and a structure that allows free movement of water. No soil in Wayne County Area closely approaches this ideal. On droughty soils, such as Boyer, Oakville, and Spinks soils, lawn grasses and shrubs dry up quickly during dry periods unless they are watered frequently. Poorly drained and very poorly drained soils, such as Hoytville and Pewamo soils, are difficult to work when wet and become hard and cloddy at the surface when dry. If such soils are disturbed by construction work, seeding lawn grass is difficult.

Public health.—Soil information is needed in planning facilities for sewage disposal and trash disposal, and in maintaining a safe and adequate water supply.

Sewage lagoons, septic tank systems, and sewer lines need to be located and constructed so that seepage or drainage from them cannot pollute water supplies. A cause of pollution is leakage from sewage lagoons constructed on unsuitable soils, such as the rapidly permeable Oakville and Spinks soils. Wells, streams, and lakes can become contaminated by runoff from clogged or improperly located septic tank absorption fields. The soil map, which shows the major drainageways of the county, can be used as a general guide in locating septic tank absorption fields that will not cause pollution. Rapid percolation of septic tank effluent can result in the pollution of shallow underground water supplies. The information in table 7 can be used as a guide in constructing sewage lagoons or in locating septic tank absorption fields.

Stability of the soil is of major importance in selecting locations for sewer lines. If the gradeline is interrupted and the systems break down, a public health hazard results. The shrink-swell potential of a soil indicates its relative stability. Corrosion is another cause of breakdown in sewer lines.

In selecting sites for sanitary landfill, it is important to consider topography, drainage, soil texture, permeability, reaction, and the nature of the underlying material. Onsite study is needed of the underlying material, the water table, and the hazards of aquifer pollution and drainage into ground water in sanitary landfill deeper than 5 or 6 feet. Table 6 lists estimates of pertinent soil properties for onsite testing.

Mosquitoes, fleas, and other disease-carrying insects breed in stagnant water. By use of the soil descriptions and the soil map, it is possible to identify areas subject to flooding or ponding. Once the possible trouble spots are located, the health hazard can be controlled by spraying to eliminate insects and installing drainage systems to remove standing water.

Recreational Development [6]

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation (fig. 19). In table 9 the soils of Wayne County Area are rated according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails.

Limitations for the specified uses are expressed as *slight, moderate,* or *severe.* For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A *slight* limitation means that soil properties are generally favorable and limitations are so minor that they easily can be 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.

[6] By CHARLES M. SMITH, biologist, Soil Conservation Service.

Figure 19.—Golf course on Kibbie and Sloan soils.

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 gentle slopes, good drainage, a surface free of rocks and coarse fragments, no flooding during periods of use, and a surface that is firm after rain but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors (fig. 20). These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils have no slopes and a surface free of rocks and coarse fragments, which greatly decreases the cost of leveling sites or of building access roads. They are free from flooding, and the surface is firm after rain but not dusty when dry.

Playgrounds are used intensively for baseball, football, badminton, and similar 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, no flooding during periods of use, and a surface that is firm after rain but not dusty when dry.

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 have slopes of less than 15 percent, few or no rocks or stones on the surface, at least moderately good drainage, flooding no more than once during the season of use, and a surface that is firm when wet but not dusty when dry.

Formation and Classification of the Soils

The pages that follow explain how the factors of soil formation have affected the formation of soils in Wayne County Area. They also define the system of soil classification and classify each soil series according to that system.

Terms commonly used in the current classification system are defined in "Soil Taxonomy" (7). Some are defined in the Glossary at the back of this survey.

TABLE 9.—*Limitations of the soils for recreational uses*

[An asterisk in the first column indicates that at least one mapping unit is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow the instructions in the first column of this table carefully. No estimates for Cut and fill land (Cu) and Made land (Ma). Material too variable]

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Belleville: Ba	Severe: wetness	Severe: wetness	Severe: wetness; too sandy.	Severe: wetness.
* Blount: BbB, BcA For Pewamo part of BcA, see Pewamo series.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness; percs slowly.	Moderate: wetness.
Boyer:				
BnB	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
BnC	Moderate: too sandy.	Moderate: too sandy.	Severe: slope	Moderate: too sandy.
Cohoctah: Cc	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.
Corunna: Co	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Edwards: Ed	Severe: dusty; wetness; flooding.	Severe: dusty; wetness; flooding.	Severe: dusty; wetness; flooding.	Severe: dusty; wetness; flooding.
Gilford: Gf	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Granby: Gr	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Houghton: Hn	Severe: dusty; wetness; flooding.	Severe: dusty; wetness; flooding.	Severe: dusty; wetness; flooding.	Severe: dusty; wetness; flooding.
Hoytville: Ho	Severe: wet; too clayey.	Severe: wet; too clayey.	Severe: wet; too clayey.	Severe: wet; too clayey.
Kibbie: KnA	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Marsh: Mb	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.
* Metamora: MeA, MfA For Pewamo part of MfA, see Pewamo series.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Metea:				
MhB	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Morley:				
MoB	Moderate: percs slowly.	Slight	Moderate: percs slowly; slope.	Slight.
MoC	Moderate: percs slowly.	Moderate: slope	Severe: slope	Slight.
MoD	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Nappanee: NaB	Severe: percs slowly; wetness.	Moderate: wetness.	Severe: percs slowly; wetness.	Moderate: wetness.
Oakville: OaB	Moderate: too sandy; soil blowing.	Moderate: too sandy; soil blowing.	Severe: too sandy; soil blowing; slope.	Severe: too sandy; slope.
* Owosso:				
OwB For Morley part, see Morley series.	Slight	Slight	Moderate: slope	Slight.
OwC For Morley part, see Morley series.	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Pella: Pc	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Pewamo: Pe	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.

TABLE 9.—*Limitations of the soils for recreational uses*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
* Selfridge: Se, SfA, SgB. For Pewamo part of SfA and SgB, see Pewamo series; for Metea part of SgB, see Metea series.	Moderate: too sandy; wetness; soil blowing.	Moderate: too sandy; wetness; soil blowing.	Moderate: too sandy; wetness; soil blowing.	Moderate: too sandy; wetness; soil blowing.
Shoals: ShB	Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; floods.
Sloan: So	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Spinks:				
SpB	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope; too sandy.	Moderate: too sandy.
SpC	Moderate: too sandy.	Moderate: too sandy.	Severe: slope; too sandy.	Moderate: too sandy.
St. Clair:				
StB	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly.	Moderate: too clayey.
StC	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly; slope.	Moderate: too clayey.
Tedrow: TeA, TfA	Moderate: wetness; too sandy.	Moderate: wetness; too sandy.	Moderate: wetness; too sandy.	Moderate: wetness; too sandy.
Thetford: ThA	Moderate: wetness; too sandy.	Moderate: wetness; too sandy.	Moderate: wetness; too sandy.	Moderate: wetness; too sandy.
Wasepi: WaA, WeA	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.

Factors of Soil Formation

Soil forms through the interaction of five major factors: 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 parent material.

Climate and plant and animal life are the active factors in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of 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 profile. It may be a long or short time, but some time is always required for differentiation of soil horizons. Generally, a long time is required for the formation 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. Many of the processes of soil formation are unknown.

Parent material

Parent material is the unconsolidated mass in which a soil forms. The parent materials of the soils of Wayne County Area were deposited by glaciers approximately 10,000 to 12,000 years ago. As the glaciers melted and retreated in Michigan, most of Wayne County Area became a lake. As the lake retreated, it left parent material consisting mostly of sand in many parts of the county. Some of the parent material was reworked and redeposited by subsequent water and wind action as the lake retreated. The parent material, left behind by all these actions, determines the limits of the chemical and mineralogical composition of the present day soils. The parent material of Wayne County Area varies greatly in its properties. It was deposited as glacial till, outwash deposits, beach deposits, lacustrine deposits, alluvium, and organic material.

Glacial till is material laid down directly by glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water washing action. The glacial till in Wayne County Area is effervescent and friable to firm. Its texture is silty clay loam, clay loam, or clay. The Blount soils are examples of soils that formed in glacial till. These soils are loamy to clayey in texture and have well-developed structures.

Outwash material is deposited by running water from melting glaciers. The size of the particles that make up outwash material varies according to the speed of the stream of water that carried them. When the water slows down, the coarser particles are deposited. Finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers of particles of

Figure 20.—Picnic area on Oakville soils.

similar size. Sandy loam, sand, pebbles, and other coarse particles are dominant. The Wasepi soils are examples of soils that formed in deposits of outwash material in Wayne County Area.

Beach material is deposited by the waves of the lake, sorting material and bringing in sand particles on the shore line as it recedes. Particles are mainly sand or fine sand. Beach deposits can be thick layers of sand or thin layers of sand. The layers vary according to the time it took for the lake to retreat. Thick layers of sand occur where the lake receded slowly. Thinner layers of sand occur where the lake receded quickly, leaving only 2 to 3 feet of sand. The Oakville soils are examples of soils that formed in thick beach deposits in Wayne County Area. The Selfridge soils are examples of soils that formed in thin beach deposits over the glacial till in Wayne County Area.

Lacustrine material is deposited from still, or ponded, glacial melt water. Because the coarser fragments drop out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remain to settle out in still water. Lacustrine deposits are loamy in texture. In Wayne County Area, soils that formed in lacustrine deposits typically have a loamy texture. The Kibbie soils are examples of soils that formed in lacustrine material.

Alluvium is deposited by floodwaters of present streams in recent time. This material varies in texture, depending on the speed of the water from which it was deposited. Loamy textured alluvium is deposited along the Huron River and Lower River Rouge because they are slow moving streams. The Shoals and Sloan soils are examples of alluvial soils.

Organic material is made up of deposits of plant remains. After the glaciers withdrew from the area, water was left standing in depressions in outwash plains, lake plains, and till plains. Grasses and sedges growing around the edges of these depressions died, and their remains fell to the bottom. Because of the wetness of the areas, the plant remains did not decompose but remained around the edge of the depression. Later, these areas were wooded with white-cedar and other water tolerant trees. As these trees died, the residue became a part of the organic accumulation. The depressions were eventually filled with organic material and formed into areas of muck. Houghton soils, for example, formed in organic material.

Plant and animal life

Plants have been the principal organisms influencing the soils in Wayne County Area. Bacteria, fungi, earthworms, and the activities of man have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kind of plants that grew on the soil. The remains of these plants accumulate on the surface, decay, and eventually become organic matter. Roots of the plants provide channels for downward movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The original vegetation in Wayne County Area was mainly deciduous forest. Differences in natural soil drainage and minor differences in parent material affected the composition of the tree species.

In general, the well-drained soils on uplands, such as the Morley, Boyer, and Owosso soils, were mainly covered with sugar maple and oak. A few wet soils had sphagnum and other mosses that contributed substantially to the accumulation of organic matter. The Pewamo and Corunna soils formed under wet conditions and contain considerable amounts of organic matter. The soils that formed under dominantly forest vegetation generally contain less total accumulated organic matter than soils in other parts of the county that formed under dominantly grass vegetation.

Climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil. It determines the amount of water available for weathering of minerals and transporting of soil materials. Climate, through its influence on temperature in the soil, determines the rate of chemical reaction in the soil. These influences are important, but they affect large areas rather than a relative small area, such as a county.

The climate in Wayne County Area is cool and humid. Presumably it is similar to the climate in existence when the soils formed. The soils in Wayne County Area differ from soils formed in a dry, warm climate or from those formed in a hot, moist climate. Climate is uniform throughout the county, although its effect is modified locally by the Detroit River and Lake Erie. The differences among the soils of Wayne County Area result, to a minor extent, from differences in climate.

Relief

Relief, or topography, has a marked influence on the soils of Wayne County through its influence on natural drainage, erosion, plant cover, and soil temperature. In Wayne County Area, slopes range from nearly level to strongly sloping. Natural soil drainage ranges from well drained on ridgetops to very poorly drained in depressions.

Relief influences the formation of soils by affecting runoff and drainage. Drainage, in turn, through its effect on aeration of the soil, determines the color of the soil. Runoff is greatest on the steeper soils, but in low areas, water is temporarily ponded. Water and air move freely through soils that are well drained and slowly through soils that are very poorly drained. In well aerated soils the iron and aluminum compounds that give most soils their color are brightly colored and oxidized. In poorly aerated soils the color is a dull gray and is mottled. The Boyer soils are examples of well-drained, well-aerated soils, and the Pewamo soils are examples of poorly aerated, poorly drained soil.

Time

Time, generally a long time, is required by the agents of soil formation to form distinct horizons from parent material. Differences in length of time that parent materials have been in place are commonly reflected in the degree of formation of the soil profile. Some soils form rapidly, others slowly.

The soils in Wayne County Area range from young to mature. The glacial deposits from which many of the soils formed have been exposed to soil-forming factors for a long enough time to allow the formation of distinct horizons within the soil profiles. The soils formed in recent alluvial sediment, however, have not been in place long enough for the formation of distinct horizons.

The Sloan soils are examples of young soils that formed in alluvial material. The Blount and Kibbie soils are examples of the effect of time on leaching of lime from the soil. The Kibbie soils were submerged under glacial lake water and protected from leaching; they are effervescent at a depth of 26 inches. In contrast, the Blount soils were above water and subject to leaching; they are leached of lime to a depth of 36 inches. The Morley soils are examples of mature soils that formed in glacial till material.

Morphology of Soils

Several processes were involved in the formation of horizons in the soils of Wayne County Area. These processes are accumulation of organic matter, leaching of lime (calcium carbonates) and other bases, reduction and transfer of iron, and formation and translocation of silicate clay minerals. In most soils of Wayne County Area more than one of these processes have been active in the formation of the horizons.

Organic matter accumulates at the surface to form an A1 horizon. The A1 horizon is mixed into a plow layer (Ap) when the soil is plowed. In the soils of Wayne County Area, the organic-matter content of the surface layer ranges from high to low. The Pella soils are examples of soils that have a high organic-matter content in the surface layer, whereas the Boyer soils are examples of soils that have a low organic-matter content.

Leaching of carbonates and other bases has occurred in most of the soils. Soil scientists generally agree that leaching of soil bases commonly precedes translocation of silicate clay minerals. Most of the soils are moderately leached. For example, the Blount soils are leached of carbonates to a depth of 36 inches.

Reduction and transfer of iron, a process called gleying, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. The gray color in the subsoil horizons indicates the reduction and loss of iron. Pewamo soils are examples of gleyed soils. Some horizons are mottled, indicating a segregation of iron. This process has occurred in the Wasepi soils.

In some soils the translocation of clay minerals has contributed to horizon formation. The eluviated (leached) A2 horizons above the illuviated (accumulation) B horizons have a platy structure, are lower in content of clay, and are generally lighter in color. The B horizons generally have an accumulation of clay (clay films) in pores and on surfaces of peds. These soils are probably leached of carbonates and soluble salts to a considerable extent before translocation of silicate clay takes place. The Morley soils are examples of soils having translocated silicate clays accumulated in the B horizon in the form of clay films.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

The comprehensive classification system currently used was adopted by the National Cooperative Soil Survey in 1965 (*4*). This system is under continual study. Readers interested in new developments and revisions of the system should search the latest available literature.

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measureable, but the properties are selected so that soils of similar genesis are grouped together. The six categories of the current system are briefly defined in the following paragraphs.

ORDER.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climate groupings of soils. Two exceptions to this are Entisols and Histosols, which occur in many different climates. The four orders represented in Wayne County are Alfisols, Entisols, Histosols, and Mollisols.

Alfisols have a clay-enriched B horizon that is high in base saturation. Wasepi, Thetford, and Blount soils represent the Alfisols in Wayne County Area.

Entisols are recent soils that lack genetic horizons or have only the beginnings of such horizons, Oakville, Tedrow, and Shoals soils are examples of Entisols in Wayne County.

Mollisols have a thick, dark-colored surface layer. Granby, Pella, and Pewamo soils are examples of Mollisols in Wayne County.

Histosols formed in organic material. They are commonly called muck, peat, organic soils, and bog soils. Houghton and Edwards soils are examples of Histosols in Wayne County .

SUBORDER.—Each order is divided into suborders, primarily on the basis of those soil characteristics that result in grouping soils according to genetic similarity. The climatic range is narrower than that of the order. The soil properties used are mainly those that reflect the presence or absence of waterlogging or differences in climate or vegetation. Aquolls and Udalfs are examples of the suborder category.

GREAT GROUP.—Each suborder is divided into great groups on the basis of similarity in the kinds and sequence of major horizons and in major soil properties. The horizons considered are those in which clay, iron, or humus have accumulated or those that have pans that interfere with the growth of roots and the movement of water. The features used are some properties of clays, soil temperature, and major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium).

SUBGROUP.—Each great group is divided into subgroups, one that represents the central typic concept of the group and others called intergrades and extragrades. Intergrade subgroups have properties of the group and also one or more properties of another great group, suborder, or order. Extragrade subgroups have properties of the group and also some properties that are not diagnostic of another great group, suborder, or order. The subgroups for each soil series in Wayne County Area are listed in table 10.

FAMILY.—Families are separated within each subgroup primarily on the basis of properties important to the growth of plants or the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, depth, slope, consistence, and coatings. A family name consists of a series of adjectives which are the class names for texture, mineralogy, and so on, that are used as family differential. An example is the sandy, mixed, mesic family.

SERIES.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangements in the profile. In table 10, each soil series in Wayne County Area is classified according to the current system of classification.

Environmental Factors Affecting Soil Use[7]

The first settlers arrived in Wayne County on July 24, 1701, the date regarded as marking the founding of Detroit. Considerable numbers of farmers came to live around Detroit. They also ventured into the forest to

[7] JOSEPH LUELLEN, JR., Soil Conservation Service, helped prepare this section.

TABLE 10.—*Classification of soils*

Soils	Family	Subgroup	Order
Belleville	Sandy over loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Blount	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Boyer	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Cohoctah	Coarse-loamy, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols.
Corunna	Coarse-loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Cut and fill land	Loamy and sandy	Not classified	Entisols.
Edwards	Marly, euic, mesic	Limnic Medisaprists	Histosols.
Gilford	Coarse-loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Granby	Sandy, mixed, mesic	Typic Haplaquolls	Mollisols.
Houghton	Euic, mesic	Typic Medisaprists	Histosols.
Hoytville	Fine, illitic, mesic	Mollic Ochraqualfs	Alfisols.
Kibbie	Fine-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Made land	Not classified	Not classified	Histosols and Entisols.
Marsh	Not classified	Not classified	Histosols and Entisols.
Metamora	Fine-loamy, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Metea [1]	Loamy, mixed, mesic	Arenic Hapludalfs	Alfisols.
Morley	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Nappanee	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Oakville	Mixed, mesic	Typic Udipsamments	Entisols.
Owosso	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Pella	Fine-silty, mixed, mesic	Typic Haplaquolls	Mollisols.
Pewamo	Fine, mixed, mesic	Typic Argiaquolls	Mollisols.
Selfridge	Loamy, mixed, mesic	Aquic Arenic Hapludalfs	Alfisols.
Shoals [1]	Fine-loamy, mixed, nonacid, mesic	Aeric Fluvaquents	Entisols.
Sloan	Fine-loamy, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols.
Spinks	Sandy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
St. Clair	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Tedrow	Mixed, mesic	Aquic Udipsamments	Entisols.
Thetford	Sandy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
Wasepi	Coarse-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.

[1] These soils are taxadjuncts. They are outside the defined range for the series with which they are here identified in the following ways:
Metea—These soils have a thinner loamy B horizon.
Shoals—These soils lack sufficient gray colors within 20 inches of the surface.

trap fur-bearing animals, and Detroit became a fur-trading center.

There were ready markets for farm products in Detroit. Some of the farm products were shipped to the growing urban centers of the middle west. The lumbering industry became important to Wayne County in 1850, becoming second in size and importance only to the manufacture of machinery. Large numbers of men found employment and the means for the profitable investment of capital in lumbering and mining, but far more people invested in land. They earned a living by cultivating the soil. Crops such as corn, wheat, oats, rye, barley, buckwheat and tobacco were produced. Other products such as butter, cheese, and wool were part of Wayne County's agriculture. The production of the farm products in 1850 was more than twice the production of ten years earlier. Development and growth of the carriage and other heavy industry, which eventually developed into the automobile industry, attracted many people to Wayne County.

The paragraphs that follow briefly describe the farming, geology, water supply, and climate in Wayne County.

Farming

According to the 1969 Census of Agriculture, there were 597 farms in Wayne County. The land area in farms was 49,527 acres, 25,562 acres of which was in harvested cropland and 1,692 acres in pastureland. Corn for grain accounted for 3,678 acres, corn for silage 428 acres, wheat 1,711 acres, oats 979 acres, and soybeans 8,960 acres, Approximately 524 acres was in clover or timothy.

Vegetables harvested in 1969 accounted for 2,068 acres. Of this acreage, sweet corn was produced on 1,293 acres, tomatoes on 209 acres, cucumbers, watermelons, snap beans, bush and pole beans on 99 acres, and pumpkin and other vegetables on 357.

Geology

A layer of glacial drift ranging in thickness from a few feet to as much as 330 feet overlies the bedrock in Wayne County. These deposits cover all of the Detroit area except for a small outcrop of bedrock in the southeastern part. The glacial deposits are thinnest near the mouth of the Detroit River and, in general, thicken gradually toward the west and more rapidly toward the northwest.

Continental glaciers picked up the mantle of soil and loose rock at the earth surface and incorporated it into the lower part of the ice along with additional material gouged from the bedrock. This material was later deposited in various forms by the melting ice.

The old glacial lakebed is a clay plain. A series of hills and ridges of sand and gravel as high as 25 to 30 feet rest on the clay plain. These hills and ridges were

formed as beaches, terraces, and river deltas by wind, waves, and stream action during the closing part of the glacial epoch. They are very porous and readily absorb a large percentage of the precipitation. Normally the water seeps downward to the water table where it moves transversely above a layer of impervious clay toward points of discharge.

Water Supply

The 1970 census reported that 7,718 housing units in Wayne County were using individual wells.

The water level in wells does not remain constant. It rises and falls in response to changes in the rate of recharge and discharge. If more water is recharged than is withdrawn, the water level rises; if more water is withdrawn than is recharged, the water level falls.

The bedrock formation immediately underlying glacial deposits in the Wayne County area consists of several hundred feet of sedimentary rocks deposited in ancient inland seas. The older rocks in Wayne County contain highly mineralized water.

The wells in glacial drift usually produce calcium magnesium bicarbonate water. The range of concentration is wide. In some wells, the wide ranges are probably caused by contamination of water from the surface or by highly mineralized water from the bedrock.

Climate [8]

Wayne County is on the southwestern shore of Lake St. Clair. The Detroit River, connecting Lake St. Clair with Lake Erie, forms the eastern boundary of approximately two–thirds of the county.

The prevailing wind direction is from the southwest at an average annual speed of 10.0 knots. The maximum average monthly windspeed and direction is 11.3 knots from the west-southwest during both January and April. February and March approximate this maximum, with an average windspeed of 11.2 knots from a west-southwest direction. The minimum average monthly windspeed and direction is 8.2 knots from the southwest during August. The fastest observed one-minute windspeed was 87 knots on June 26, 1973.

As a result of the prevailing winds, the influence of Lake St. Clair and Lake Erie is limited to local lake breezes or to storm tracks that blow from the east off of the lakes. West and northwest are downslope of the Irish Hills area, which is located to the west and northwest of the county and rises to a relative height of 500 to 600 feet above the average river level of the east boundary. This subsidence provides some warming and drying of the air flowing downslope, while the opposite processes occur on winds blowing upslope.

Climatological data for the county are given in tables 11, 12, and 13. The average annual maximum temperatures range from 58.3° F. at the Detroit City Airport to 60.3° at the Dearborn climatological station, with an intermediate temperature of 58.7° at the Detroit Metropolitan Airport. Lake breezes can lower daily maximum temperatures by as much as 15° relative to the areas not under their influence. The average annual minimum temperatures range from 39.4° at the Detroit Metropolitan Airport to 41.4° at the Detroit City Airport, with an intermediate temperature of 40.6° at the Dearborn climatological station.

The large urban industrial area of the county affects the climate by creating the urban "heat island" effect. The difference in minimum temperatures between urban and rural areas can exceed 10° under extreme conditions. The highest temperature of record is 105° in July 1934, and the lowest temperature of record is -24° in December 1872. On the average, temperatures of more than 90° occur 15 times during the summer, and temperatures below 0° occur four times during the winter. The highest mean monthly temperature was 79.1° in July 1955, and the lowest mean monthly temperature was 15.8° in January 1963.

The average annual number of heating and cooling degree days (base 65° F.) are 6,233 and 875 respectively. January is the coldest with an average of 1,238 heating degree days, and July is the warmest with an average of 275 cooling degree days.

The growing season averages 170 days. At Dearborn, the average date of the last freezing temperature in spring is April 26, and the average date of the first freezing temperature in fall is October 19.

More than half of the annual precipitation, an average of 63 percent, falls during the 6-month period from April through September. June is the month of the heaviest average precipitation, and February is the month of the lightest. The wettest month of record was July 1878, when precipitation measured 8.76 inches. The driest month of record was February 1877, when precipitation measured 0.04 inches. The maximum precipitation recorded during a 24-hour period was 4.75 inches at Detroit Metropolitan Airport on July 31, 1925. About once in 2 years, as much as 1.1 inches of rain falls in an hour, as much as 1.3 inches in 2 hours, and as much as 2.1 inches in 24 hours. About once in 10 years, as much as 3.5 inches falls in 24 hours, and once in 50 years, as much as 4.7 inches falls in 24 hours.

Data recorded at Dearborn indicate that the average total evaporation (Class A pan) between the first of May and the end of October is 34.71 inches, which is more than twice the average total rainfall of 15.75 inches for the same period. The deficit is made up from water stored in the soils since the recharging of the water table by the rains of winter and early spring.

Snowfall averages 32 inches a year but varies considerably from year to year. During the last 40 years, annual totals have ranged from 58 inches in the 1951-52 season to 11 inches in the 1948-49 season. Measurable amounts of snow usually fall each month from October through April. Cloudy days are most common late in fall and early in winter and least common late in spring and in summer. Data from the National Weather Service for Detroit City Airport for the past 32 years indicate that January averaged 4 clear days, 6 partly cloudy days, and 21 cloudy days; July averaged 9 clear days, 13 partly cloudy days, and 9 cloudy days.

[8] FRED V. NURNBERGER, meterologist for Michigan Department of Agriculture, Weather Service, helped prepare this section.

TABLE 11.—*Temperature and precipitation*

[Based on U.S. National Weather Service records kept at Dearborn, Wayne County, Michigan for the period 1953–70]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Average number of days with 1 inch or more of snow cover	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F	°F	°F	°F	Inches	Inches	Inches		Inches
January	32.0	17.7	46	1	1.60	0.50	2.86	18	2.6
February	36.1	19.9	50	5	1.36	.33	2.76	14	2.6
March	45.1	26.9	66	13	1.89	.94	3.27	7	2.5
April	60.6	38.4	79	27	3.00	1.41	4.63	1	1.6
May	71.7	48.0	86	36	2.77	1.51	4.20	0	0
June	81.1	57.5	93	45	3.84	1.87	6.21	0	0
July	85.0	62.0	93	52	3.24	1.20	5.55	0	0
August	83.4	60.8	93	51	3.46	1.44	5.94	0	0
September	76.6	54.1	90	41	2.44	1.15	4.12	0	0
October	65.7	43.9	80	31	2.32	.54	4.45	0	0
November	49.9	33.8	66	21	2.00	.83	3.67	2	2.0
December	36.9	23.2	53	7	1.85	.43	4.34	12	2.5
Year	60.3	40.6	[1] 96	[2] −3	29.75	22.76	38.02	54	2.3

[1] Average yearly maximum.

[2] Average yearly minimum.

TABLE 12.—*Probabilities of last freezing temperatures in spring and first in fall*

[Based on data from Dearborn for the period 1953–72]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 29	April 6	April 14	April 27	May 11
2 years in 10 later than	March 24	April 1	April 9	April 22	May 6
5 years in 10 later than	March 14	March 22	March 30	April 12	April 26
Fall:					
1 year in 10 earlier than	November 19	November 12	October 27	October 16	October 3
2 years in 10 earlier than	November 24	November 17	November 1	October 21	October 8
5 years in 10 earlier than	December 5	November 28	November 12	November 1	October 19

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(7) ————1973. Soil taxonomy, a basic system of soil classification for making and interpreting soil surveys.

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TABLE 13.—*Probabilities of snow cover of specified depth before given dates*

[Based on depth of snow cover at Detroit observed at 7 a.m. The dates are found in "Michigan Snowfall Statistics; First 1–, 3–, 6–, and 12–inch depths," June 1968]

Probability	Depth of snow cover			
	1 inch	3 inches	6 inches	12 inches
5 percent	November 1	November 4	November 30	January 16
10 percent	November 7	November 15	December 13	January 20
30 percent	November 20	December 8	January 11	January 28
50 percent	November 29	December 23	January 18	
70 percent	December 8	January 8	March 22	
90 percent	December 21	February 1		

Glossary

[Asterisks indicate terms used in tables 7 and 8]

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; but that in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

***Area reclaim.** An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bedrock. The solid rock that underlines the soil and other unconsolidated material or that is exposed at the surface.

Blowout. An excavation produced by wind action in loose soil, usually sand.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles more than 2 millimeters in diameter.

Coarse-textured soil. Sand and loamy sand.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

***Complex slope.** Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

***Compressible.** Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found 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.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Contour stripcropping. Growing crops in strips that follow the contour or are parallel to terraces or diversions. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Crusty soil. Soil tending to form a thin, massive or platy surface layer under the beating action of raindrops. The opposite of "crusty" is "self-mulching."

***Cutbanks cave.** Unstable walls of cuts made by earthmoving equipment. This soil sloughs easily.

Delta. An alluvial deposit, formed largely beneath the water, where a stream or river drops its load of sediment on entering a body of more quiet water. Commonly triangular in shape.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, 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 different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Effluent. The outflow of water from a subterranean storage space. The term is also used in reference to gases and other liquids.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

***Excess fines.** Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

***Fast intake.** The rapid movement of water into the soil.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Fine-textured soils. *Moderately fine textured*: clay loam, sandy clay loam, silty clay loam; *fine-textured*: sandy clay, silty clay, and clay. Roughly, soil that contains 35 percent or more of clay.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

***Frost action.** Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Glacial drift (geology). Rock material transported by glacial ice and then deposited; also includes the assorted and unassorted materials deposited by streams flowing from glaciers.

Glacial outwash (geology). Crossbedded gravel, sand, and silt deposited by melt water as it flowed from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; the deposits are stratified and occur in the form of kames, eskers, deltas, and outwash plains.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Gravelly soil material. From 15 to 50 percent of material by volume, consists of rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

Green manure (agronomy). A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Habitat. The natural abode of a plant or animal; it refers to the kind of environment in which a plant or animal normally lives as opposed to its range, or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

Leaching. The removal of soluble materials from soils or other material by percolating water.

***Low strength.** Inadequate strength for supporting loads.

Medium-textured soil. Soil of very fine sandy loam, loam, silt loam, or silt texture.

Mineral soil. Soil composed mainly of inorganic (mineral) material and low in content of organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. The amount of tillage required to create the proper soil condition for seed germination, plant establishment, and prevention of competitive growth.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are: terminal, lateral, medial, ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical mineral, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Organic soil. A general term applied to a soil or to a soil horizon that consists primarily of organic matter, such as peat soils, muck soils, and peaty soil layers. In chemistry, organic refers to the compounds of carbon.

Peat. Unconsolidated soil material, largely undecomposed organic matter, that has accumulated under conditions of excess moisture.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Percolation. The downward movement of water through the soil.

*Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

*Piping. Formation by moving water of subsurface tunnels or pipelike cavities.

Plow layer. The soil ordinarily moved in tillage; equivalent to surface soil.

*Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Puddled soil. A soil that is dense, massive, and without regular structure because it has been artificially compacted when wet. Commonly, a puddled soil is a clayey soil that has been tilled when wet.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	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.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

*Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

*Shrink swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class 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 times 100. Thus a slope of 10 percent is a drop of 10 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes 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 characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers such as stratified alluvium. The term is confined to geological 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 clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 particle) alhering together without any regular cleavage, as in many claypans and hardpans).

Subsidence. A settling or packing down of the soil material, as exemplified by muck that has been drained and cultivated many times.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

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 may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tile drain. Concrete or pottery pipe placed at suitable spacings and depths in the soil or subsoil to provide water outlets from the soil.

Till plain (geology). A level or undulating land surface covered by till, which is unstratified glacial drift consisting of clay, sand, gravel, and boulders intermingled; also known as ground moraine.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which the mapping unit belongs. The symbol in parentheses in the capability unit is the management group to which the mapping unit belongs on a statewide basis.

Map symbol	Mapping unit	Page	Capability unit		Woody plant group
			Symbol	Page	Number
Ba	Belleville loamy fine sand	14	IIIw-4 (4/2c)	43	5
BbB	Blount loam, 0 to 4 percent slopes	15	IIw-2 (1.5b)	40	2
BcA	Blount-Pewamo loams, 0 to 2 percent slopes	15	IIw-2 (1.5b, 1.5c)	40	2
BnB	Boyer loamy sand, 0 to 6 percent slopes	16	IIIs-1 (4a)	43	3
BnC	Boyer loamy sand, 6 to 12 percent slopes	16	IIIe-4 (4a)	42	3
Cc	Cohoctah fine sandy loam, frequently flooded	17	Vw-1 (L-2c)	44	5
Co	Corunna fine sandy loam	18	IIw-4 (3/2c)	41	5
Cu	Cut and fill land	18	----------	--	---
Ed	Edwards muck	19	IVw-1 (M/mc)	44	1
Gf	Gilford sandy loam	20	IIIw-3 (4c)	43	5
Gr	Granby loamy fine sand	21	IIIw-3 (5c)	43	5
Hn	Houghton muck	21	IIIw-5 (Mc)	43	1
Ho	Hoytville silty clay loam	22	IIw-1 (1c)	40	5
KnA	Kibbie fine sandy loam, 0 to 3 percent slopes	23	IIw-3 (2.5b)	40	2
Ma	Made land	23	----------	--	---
Mb	Marsh	23	VIIIw-1	45	---
MeA	Metamora sandy loam, 0 to 3 percent slopes	24	IIw-4 (3/2b)	41	2
MfA	Metamora-Pewamo complex, 0 to 3 percent slopes	24	IIw-4 (3/2b, 1.5c)	41	2
MhB	Metea loamy sand, 2 to 6 percent slopes	25	IIIe-3 (4/2a)	42	3
MoB	Morley loam, 2 to 6 percent slopes	25	IIe-1 (1.5a)	40	4
MoC	Morley loam, 6 to 12 percent slopes	25	IIIe-3 (1.5a)	42	4
MoD	Morley loam, 12 to 18 percent slopes	26	IVe-1 (1.5a)	44	4
NaB	Nappanee silt loam, 0 to 4 percent slopes	26	IIIw-1 (1b)	42	2
OaB	Oakville fine sand, 0 to 6 percent slopes	27	IVs-1 (5a)	44	3
OwB	Owosso-Morley complex, 2 to 6 percent slopes	28	IIe-1 (3/2a, 1.5a)	40	4
OwC	Owosso-Morley complex, 6 to 12 percent slopes	28	IIIe-3 (3/2a, 1.5a)	42	4
Pc	Pella silt loam	29	IIw-3 (2.5c)	40	5
Pe	Pewamo loam	29	IIw-1 (1.5c)	40	5
Se	Selfridge loamy sand, 0 to 3 percent slopes	30	IIIw-4 (4/2b)	43	2
SfA	Selfridge-Pewamo complex, 0 to 2 percent slopes	31	IIIw-4 (1.5c, 4/2b)	43	2
SgB	Selfridge-Pewamo-Metea complex, 0 to 4 percent slopes	31	IIIw-4 (4/2b, 4/2a, 1.5c)	43	2
ShB	Shoals silt loam	32	IIw-3 (L-2c)	40	2
So	Sloan silt loam, wet	33	Vw-1 (L-2c)	44	5
SpB	Spinks loamy sand, 0 to 6 percent slopes	33	IIIs-1 (4a)	43	3
SpC	Spinks loamy sand, 6 to 12 percent slopes	34	IIIe-4 (4a)	42	3
StB	St. Clair clay loam, 2 to 6 percent slopes	34	IIIe-1 (1a)	41	2
StC	St. Clair clay loam, 6 to 12 percent slopes	34	IIIe-2 (1a)	41	2
TeA	Tedrow loamy fine sand, 0 to 2 percent slopes	36	IIIw-2 (5b)	42	2
TfA	Tedrow loamy fine sand, loamy substratum, 0 to 2 percent slopes	36	IIIw-2 (5/2b)	42	2
ThA	Thetford loamy sand, 0 to 2 percent slopes	37	IIIw-2 (4b)	42	2
WaA	Wasepi loamy sand, 0 to 2 percent slopes	37	IIIw-2 (4b)	42	2
WeA	Wasepi loamy sand, loamy substratum, 0 to 2 percent slopes	37	IIIw-2 (4/2b)	42	2

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