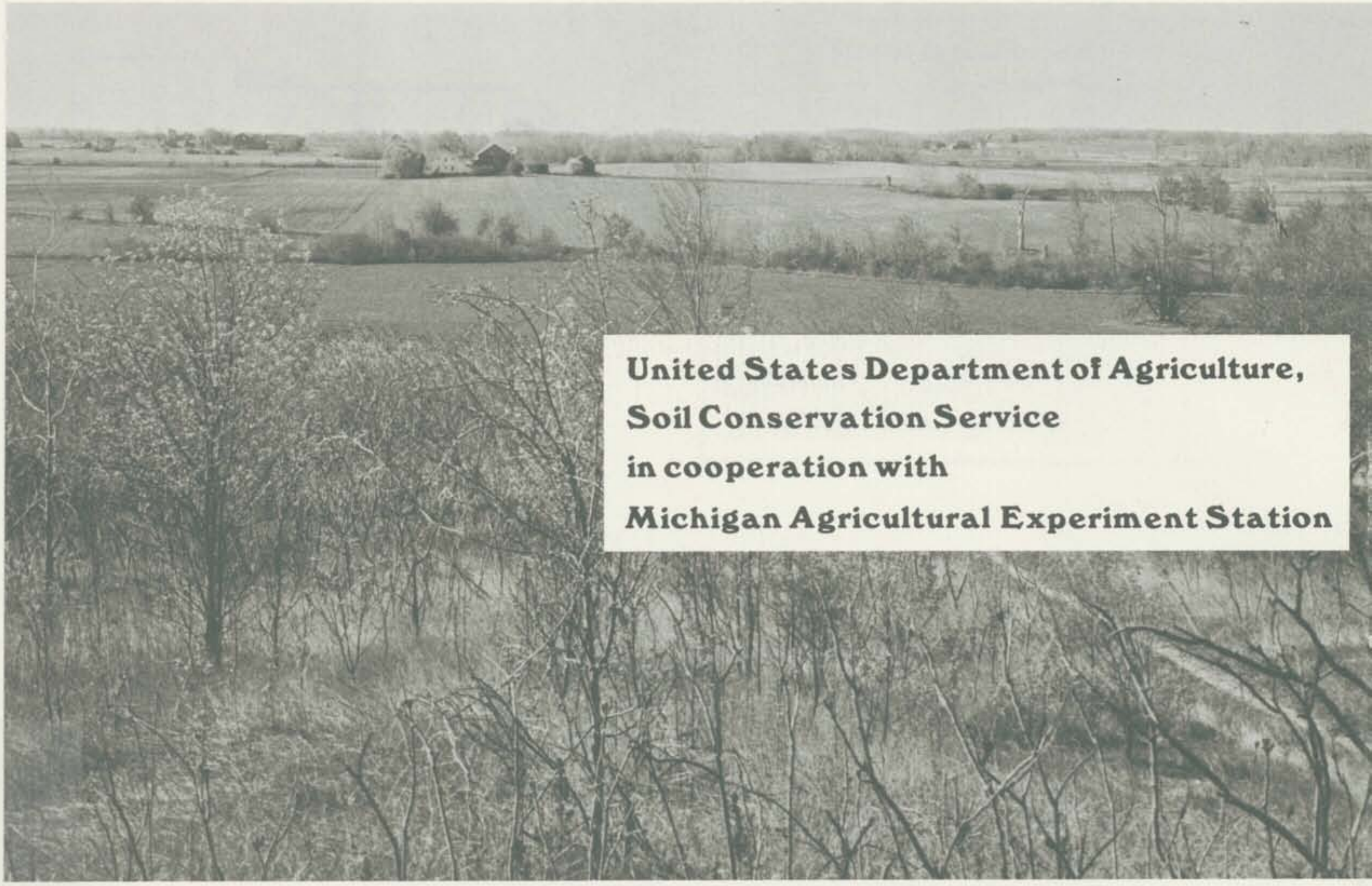
SOIL SURVEY OF

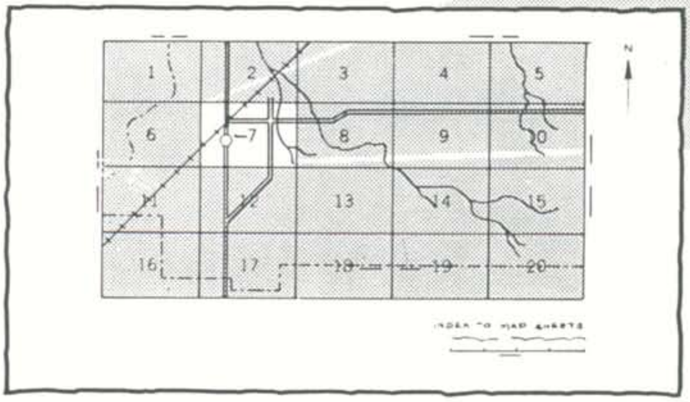
Huron County, Michigan

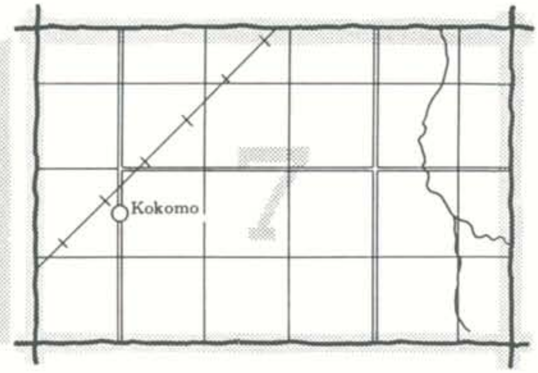


United States Department of Agriculture,
Soil Conservation Service
in cooperation with
Michigan Agricultural Experiment Station

HOW TO USE

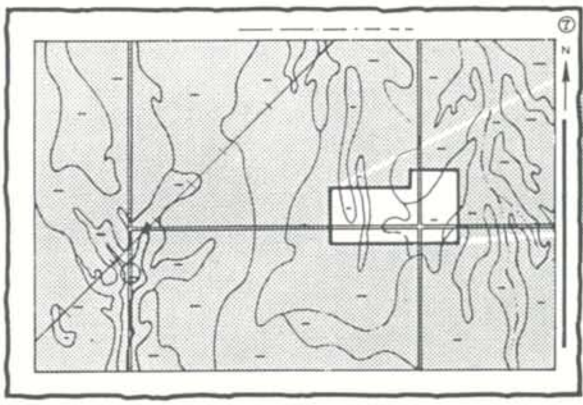
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

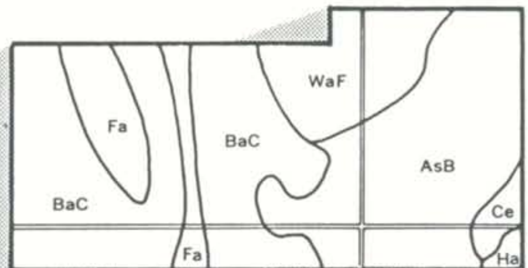




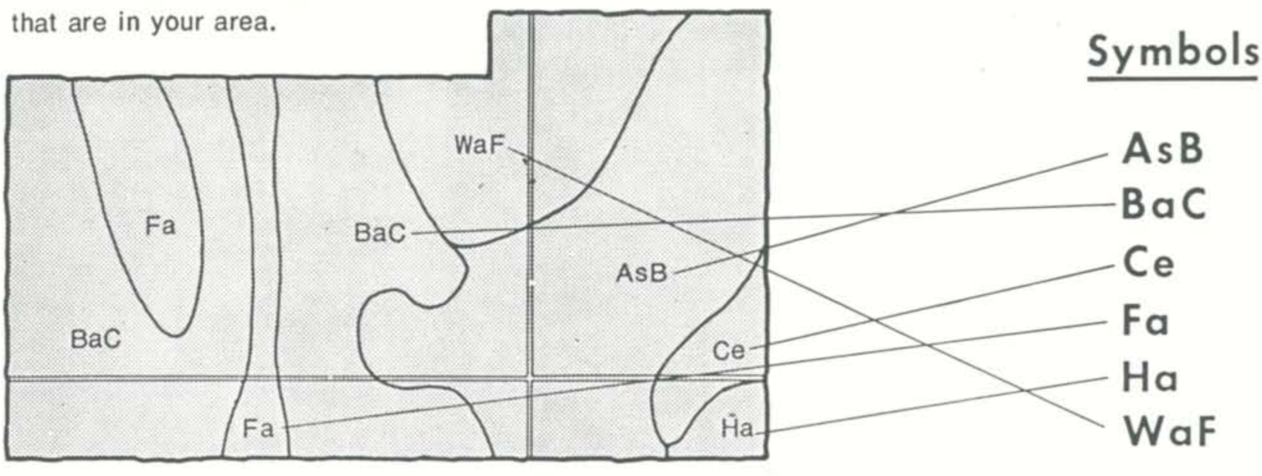
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



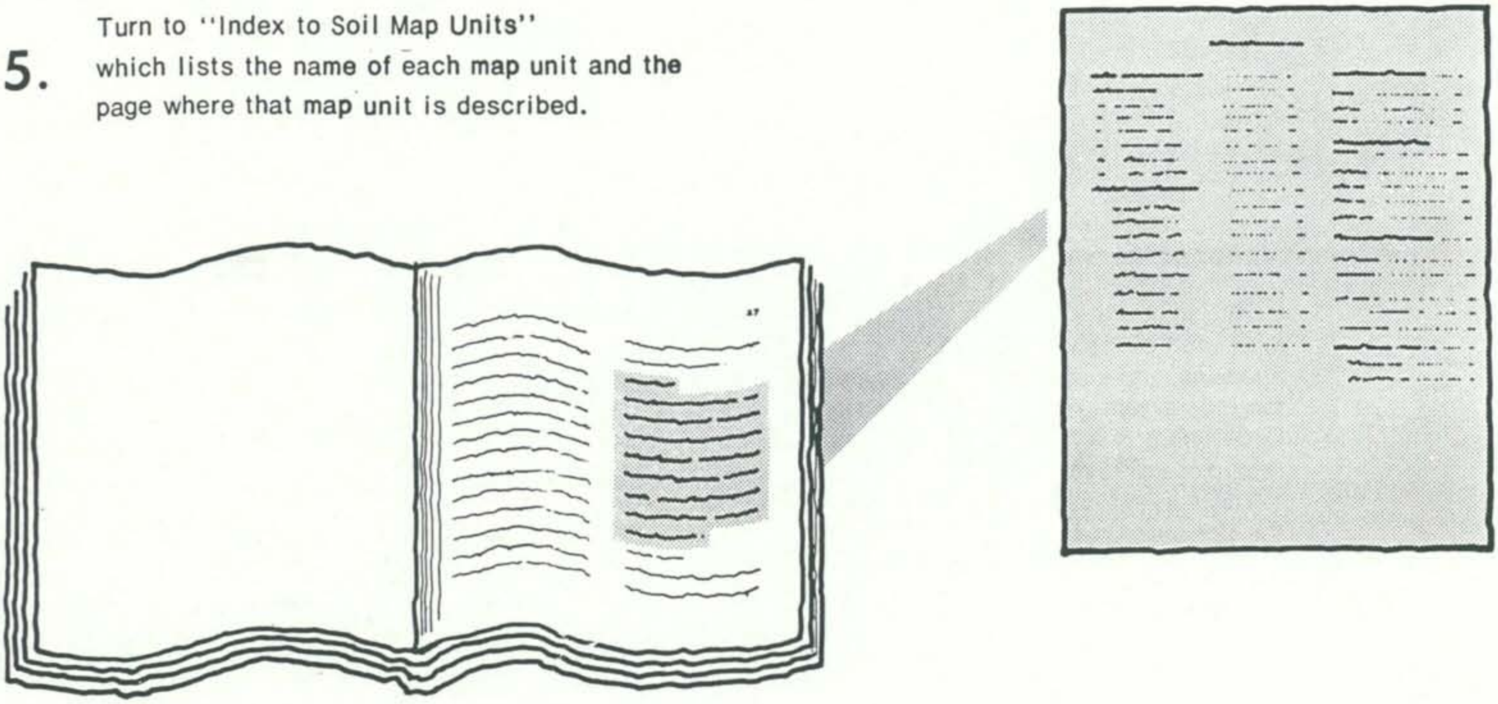


4. List the map unit symbols that are in your area.

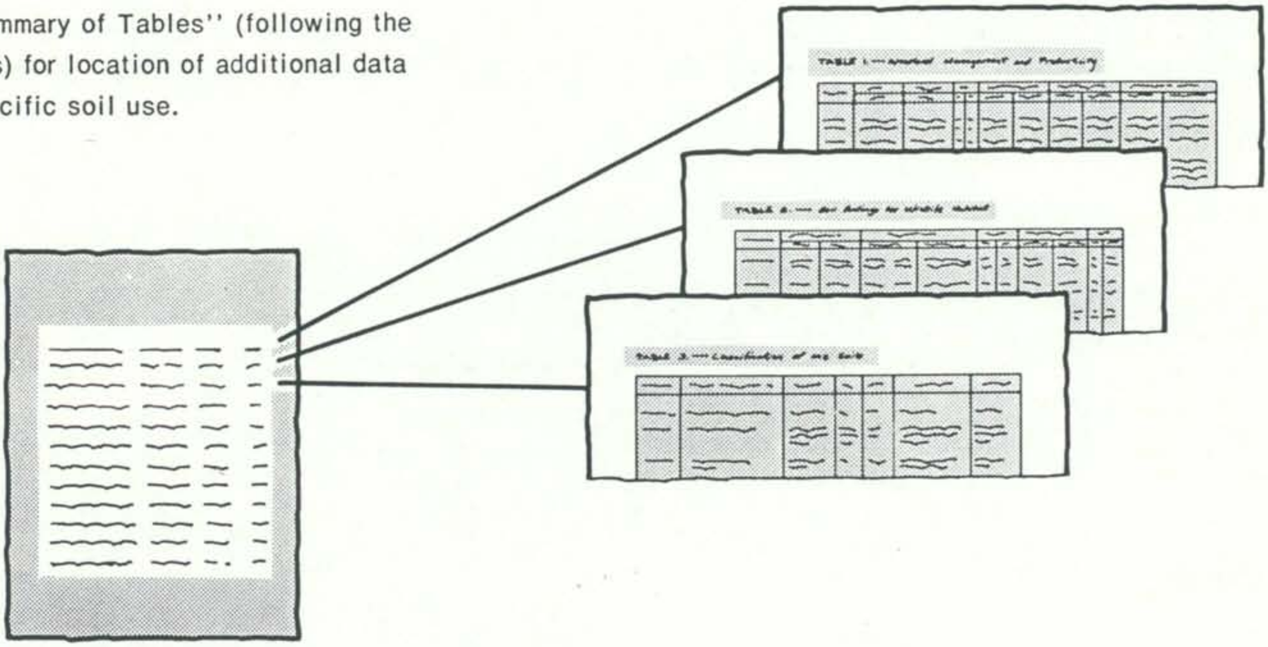


THIS SOIL SURVEY

5. Turn to ''Index to Soil Map Units'' which lists the name of each map unit and the page where that map unit is described.



6. See ''Summary of Tables'' (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1972-77. Soil names and descriptions were approved in September 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Huron County Soil Conservation Service and the Michigan Agricultural Experiment Station. It is part of the technical assistance furnished to the Soil Conservation District. Preparation of this soil survey was partly financed by the Huron County Board of Commissioners under provisions of an agreement with the Soil Conservation Service, U. S. Department of Agriculture, and the Michigan Agricultural Experiment Station.

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

Cover: Landscape of Parkhill loam and Londo loam, 0 to 2 percent slopes. Center ditch removes excess water from poorly drained Parkhill soil.

Contents

Issued January 1980

Index to soil map units

Summary of tables

Summary of tables—Continued

Foreword

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

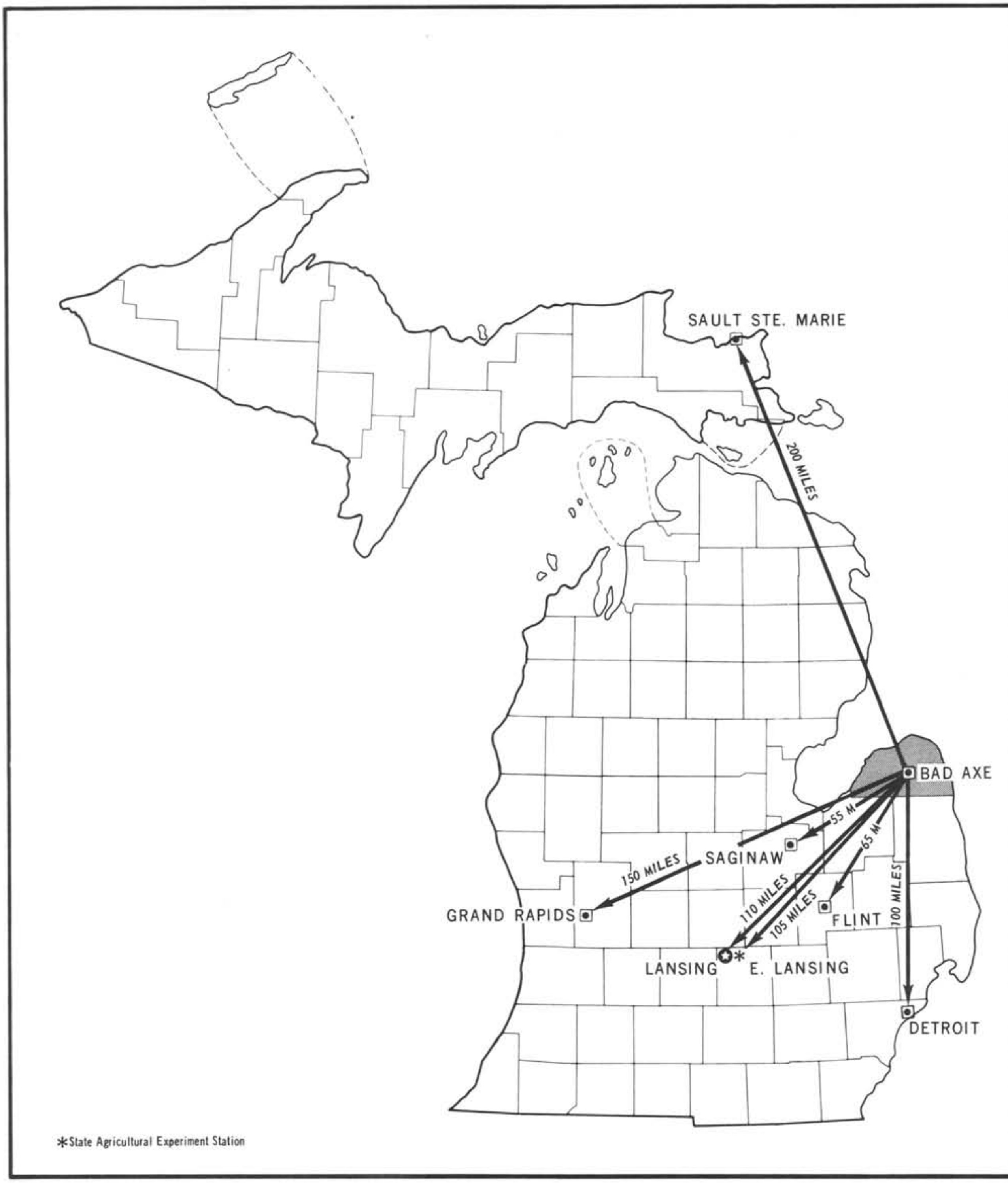
This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey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

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

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

Arthur H. Cratty

A. H. Cratty
State Conservationist
Soil Conservation Service



Location of Huron County in Michigan.

SOIL SURVEY OF HURON COUNTY, MICHIGAN

By Lyle H. Linsemier, Soil Conservation Service

Fieldwork by E. Selden Cowan, William E. Frederick, Lyle H. Linsemier, David Lietzke, and Wesley K. Mettert, Soil Conservation Service; and Craig Bernthal, Ray Laurin, Robert McLeese, Patrick Sutton, David Walling, Ronald Church, and Ted Zobeck, Michigan Agricultural Experiment Station

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

Huron County is in the thumb area of Michigan. Bad Axe, the county seat, has a population of 2,999. The county has a total of 530,015 acres, or 828 square miles. This includes a wetland wildlife area of 3,935 acres.

The southern and central parts of the county consist of a gently undulating to hilly moraine. Extending out beyond the moraine toward Saginaw Bay and Lake Huron is a broad, nearly level till plain. Small streams transect the till plain and drain toward Saginaw Bay and Lake Huron.

General nature of the county

This section gives general information concerning the county. It discusses climate, settlement of the county, farming, and natural resources.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Bad Axe and Harbor Beach in the period 1947 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 23.8 degrees F at Bad Axe and 24.2 degrees at Harbor Beach; and the average daily minimum temperature is 16.3 degrees at Bad Axe and 17.5 degrees at Harbor Beach. The lowest temperature on record is -23 degrees at Bad Axe on 1-30-51 and -24 degrees at Harbor Beach on 2-5-18. In summer the average temperature is 67.7 degrees at Bad Axe and 66.6 degrees at Harbor Beach. The average daily maximum temperature is 79.7 degrees at Bad Axe and 76.5 degrees at Harbor Beach. The highest temperature recorded at Bad Axe is 103 degrees on 7-8-36 and 7-13-36, and at Harbor Beach is 105 degrees on 7-10-36.

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

Of the total annual precipitation, 16.26 inches, or 56 percent, at Bad Axe and 17.78 inches, or 52 percent, at Harbor Beach usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 13.8 inches at Bad Axe and 14.8 inches at Harbor Beach. The heaviest 1-day rainfall during the period of record was 3.50 inches at Bad Axe and 4 inches at Harbor Beach, both on 6-17-35. Thunderstorms occur on about 31 days each year, and most occur in June, July, and August (about six each month).

Average seasonal snowfall is 56.1 inches at Bad Axe and 84.3 inches at Harbor Beach. The greatest snow depth at any one time during the period of record was 23 inches at Bad Axe on 2-11-47 and 28 inches at Harbor Beach on 1-12-69 and 1-14-69. On the average, Bad Axe has 73 days with at least 1 inch of snow on the ground and Harbor Beach has 89 days, but the number of days varies greatly from year to year. The greatest total seasonal snowfall at Bad Axe was 89.1 inches for 1946-47 and at Harbor Beach was 141 inches for 1966-67. The least total snowfall occurred in 1932-33, when Bad Axe had 21 inches and Harbor Beach had only 14 inches.

The nearest available data recorded at Flint indicates that the average relative humidity at 1 PM is about 61 percent. Humidity is higher at night and near the lake. The average at dawn is about 80 percent. Data recorded at Detroit indicate that sunshine is possible 67 percent of the time in summer and 35 percent of the time in winter. The prevailing wind is from the southwest. The average windspeed is highest, 12.2 miles per hour, in March.

Local lake breezes change the diurnal and seasonal pattern of wind, depending on the orientation of the shoreline to the general wind flow.

Climatic data in this section were specially prepared for the Soil Conservation Service by the Michigan Department of Agriculture Weather Service at East Lansing.

Settlement of the county

Trappers and shingle weavers were the first settlers in the county other than Indians. They found stands of white pine and deciduous trees and, in the swamps, dense growths of cedar and tamarack. As soon as the land was cleared by the lumbermen, small groups of pioneer settlers followed to till the land.

Huron County was marked off in 1840 and formally organized in 1859. Population showed a continuous increase from the first census until 1910, when it was 34,748. Since then there has been a slight decrease to 34,083.

Bad Axe, the county seat, is the largest town in the county. Other major towns and villages are Pigeon, Elkton, Kinde, Harbor Beach, Port Austin, Ubly, Caseville, and Sebewaing.

Farming

The first farms of Huron County were in areas that had been cleared by the lumbermen. Early farmers faced many problems in planting their crops. Trees and stumps had to be removed and many large swampy areas had to be drained.

The first major crop was potatoes, which in many areas could only be planted between the tree stumps left by the lumbermen. Some settlers let their cattle roam the woods and shrubs for forage, and others cut marsh grass for hay.

Many farms were established in the 1850's and 1860's, but the great forest fires of 1871 and 1881 destroyed many crops and left hundreds of people homeless. After the fires farming emerged as the major industry in the county, replacing the lumbering industry.

In 1965 the Huron County Soil Conservation District was formed to help local landowners control soil erosion and pollution. Huron County is now one of the nation's leading producers of navy beans, sugar beets, grains, dairy products, and livestock.

The total land area of the county is about 526,080 acres. Of this, about 91 percent, or 470,000 acres, is in farms.

The high productivity of many soils, the climatic conditions, and the economic conditions indicate that the future economy of Huron County will continue to be based largely on agricultural products.

Natural resources

Natural resources have played an important role in the history and development of Huron County. In the past, some major resources were grindstones from the Grindstone City area and lumber from the Port Hope, Port Crescent, and Caseville areas. With technical advances and the removal of the great forests, the economy of the area changed. Lumbering gave way to a great farming industry.

Soil is now the major natural resource in the county. Livestock that are raised for milk and beef as well as the crops produced on farms are marketable products that are derived from the soil.

Limestone and sandstone bedrock in some areas of the county are mined for use in road and building construction. Many areas in the county are underlain by coarse sand and gravel, which are important sources of roadfill. Brine wells and a few oil wells are scattered throughout the county.

Some commercial fishing is still conducted from the Bay Port area. Although some small industries have been developed in the county, agriculture remains the chief source of income for most residents.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the underlying material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

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

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

Nearly level to rolling soils that have a medium textured surface layer and medium textured or moderately fine textured subsoil

These soils are generally poorly suited as building sites and septic tank absorption fields because they are wet or because they are wet and very slowly permeable in the underlying material.

1. Shebeon-Kilmanagh

Nearly level and gently undulating, somewhat poorly drained and poorly drained soils that formed in firm glacial till

This map unit is on a nearly level till plain. Slopes are steeper along major drainageways and streams and are generally short (fig. 1).

This map unit occupies about 54 percent of the county. About 35 percent of the map unit is Shebeon soils, 30 percent is Kilmanagh soils, and the remaining 35 percent is soils of minor extent. Shebeon soils in most places are slightly higher in elevation than the Kilmanagh soils.

Shebeon soils are nearly level to gently undulating and are somewhat poorly drained. The surface layer typically is dark brown loam about 11 inches thick. The mottled, firm clay loam subsoil is about 12 inches thick. The upper part of the subsoil is yellowish brown; the lower part is grayish brown. The substratum, to a depth of 60 inches, is firm grayish brown and very firm yellowish brown mottled loam.

Kilmanagh soils are nearly level and are poorly drained. The surface layer typically is very dark gray loam about 9 inches thick. The subsoil is about 20 inches thick and is gray and dark yellowish brown mottled loam. It is underlain by dark yellowish brown and brown, mottled, friable and very firm loam to a depth of 60 inches.

Minor soils in this map unit are the moderately well drained Grindstone soils and the somewhat poorly drained Avoca and Badaxe soils. The Grindstone soils are on the more pronounced knolls and divides. Areas of Avoca and Badaxe soils are closely intermingled with Shebeon soils. Avoca soils are sandy, and Badaxe soils are sandy loam, loamy sand, and loam in texture.

This map unit is used mainly for cultivated crops, but a few small, undrained areas are wooded or are in permanent pasture. Most of the acreage has been cleared and some has been drained. The main limitation to use of these soils for farming and for most other purposes is wetness. Flooding is common in lower areas in winter and spring.

If adequately drained, these soils have good potential for cultivated farm crops commonly grown in the county. Because wetness is a severe problem and difficult to overcome, the potential for most urban and recreational development is poor. The potential for development of wetland wildlife habitat is good on the poorly drained Kilmanagh soils.

2. Aubarque-Filion

Nearly level and gently undulating, somewhat poorly drained and poorly drained soils that formed in firm glacial till

This map unit is on a gently undulating till plain and adjacent lake terrace. Slopes are steeper along the lake terrace and major drainageways and streams. Slopes are generally short (fig. 2).

This map unit occupies about 6 percent of the county. About 40 percent of the map unit is Aubarque soils, 10 percent is Filion soils, and the remaining 50 percent is soils of minor extent. Aubarque soils on the till plain are higher in elevation than the Filion soils on the lake terrace.

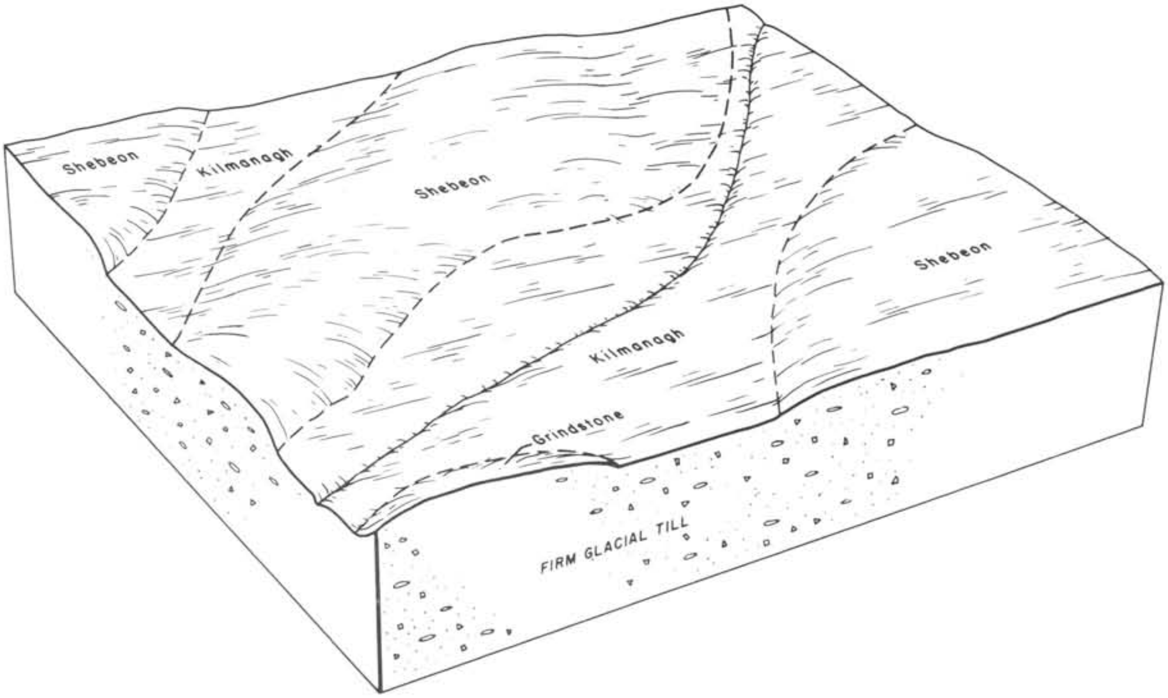


Figure 1.—Pattern of soils and underlying material in the Shebeon-Kilmanagh map unit.

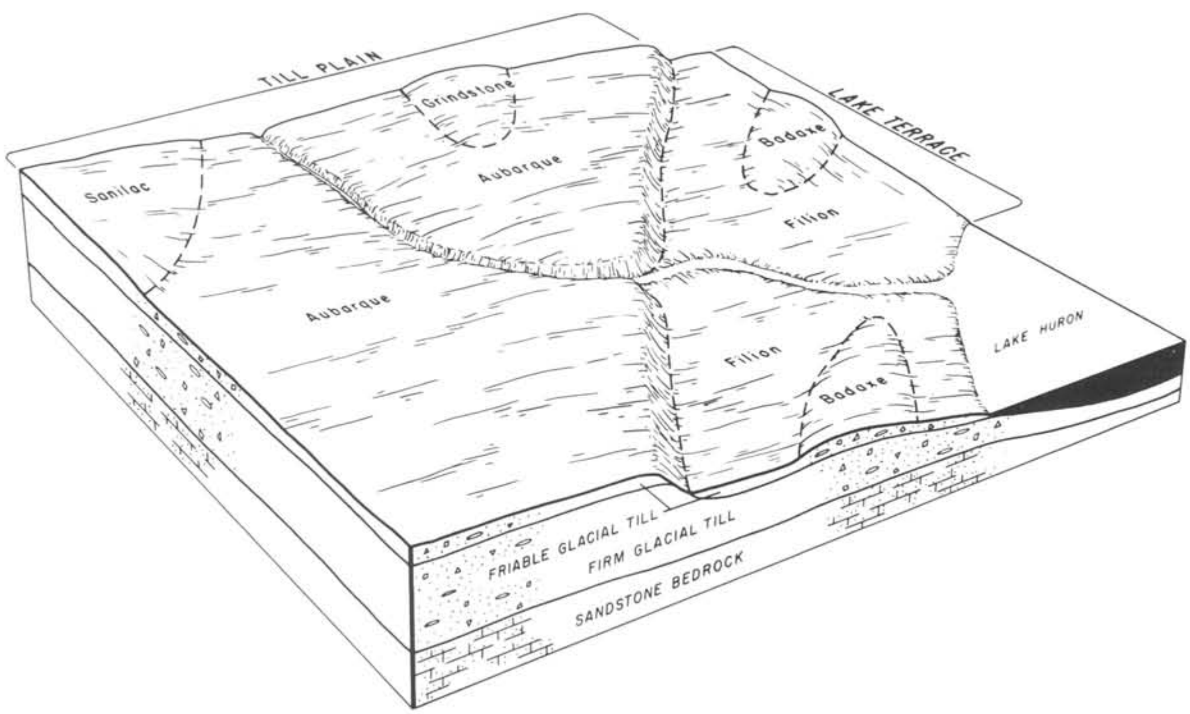


Figure 2.—Pattern of soils and underlying material in the Aubarque-Filion map unit.

Aubarque soils are nearly level to gently undulating and are somewhat poorly drained. The surface layer typically is dark grayish brown loam about 12 inches thick. The subsoil, about 5 inches thick, is yellowish brown mottled, friable loam. The substratum, to a depth of 60 inches, is brown, pale brown, and reddish brown, very firm and extremely firm loam.

Filion soils are nearly level and poorly drained. The surface layer typically is very dark gray stony loam about 5 inches thick. The subsoil is gray, mottled, firm loam about 9 inches thick. The substratum is pale olive, olive gray, and gray, very firm loam and clay loam to a depth of 60 inches.

Minor soils in this map unit are the moderately well drained Grindstone soils, the somewhat poorly drained Shebeon, Sanilac, and Badaxe soils, and the poorly drained Kilmanagh soils. The higher, more favorably drained areas on the till plain are occupied by the Grindstone soils. Areas of the stratified, loamy Sanilac soils are closely intermingled with areas of the Aubarque soils. Badaxe cobbly loam soils are in the better drained areas of the lake terrace. Shebeon soils are in positions on the landscape similar to Aubarque soils, and Kilmanagh soils are in positions similar to Filion soils.

This map unit is used mainly for pasture and cultivated crops. Most of the acreage has been cleared, and some has been drained. Wetness and very slow permeability in both the Aubarque and Filion soils and flooding and stones on the Filion soils are the main concerns in farming and most other uses of these soils.

If adequately drained, these soils have fair potential for the cultivated crops commonly grown in the county. Wetness, very slow permeability, and frost action in both the Aubarque and Filion soils and flooding in the Filion soils are the major problems to overcome when considering most building and recreational development. The potential for such development is poor. The potential for development of wetland wildlife habitat is good on the poorly drained Filion soils.

3. Grindstone-Kilmanagh

Nearly level and gently undulating, moderately well drained and poorly drained soils that formed in firm glacial till

This map unit is on a gently undulating till plain that has an intricate pattern of drainageways, divides, knolls, and swales. Slopes are steeper along the few large drainageways. All slopes are short.

This map unit occupies about 3 percent of the county. About 45 percent of the map unit is Grindstone soils, 15 percent is Kilmanagh soils, and the remaining 40 percent is soils of minor extent. Grindstone soils are higher in elevation than the Kilmanagh soils.

Grindstone soils are nearly level to gently undulating and are moderately well drained. The surface layer typically is dark grayish brown loam or cobbly loam about 9 inches thick. The subsoil, about 18 inches thick, is yellowish brown, light yellowish brown, and brown, mottled clay loam and silt loam. The substratum, to a depth of about 60 inches, is brown, mottled, very firm loam.

Kilmanagh soils are nearly level and are poorly drained. The surface layer typically is very dark gray loam or cobbly loam about 9 inches thick. The subsoil is about 20 inches thick, and is gray and dark yellowish brown, mottled loam. It is underlain by dark yellowish brown and brown, mottled, friable and very firm loam to a depth of 60 inches.

Minor soils in this unit are the somewhat poorly drained Londo, Shebeon, and Badaxe soils and the poorly or very poorly drained Parkhill soils. Areas of the loamy Shebeon, Parkhill, and Londo soils and the Badaxe sandy loams, loamy sands, and loams are closely intermingled with Grindstone and Kilmanagh soils. The Grindstone and Kilmanagh soils are not mapped separately in much of this map unit because they occur in a complex pattern.

This map unit is used mainly for cultivated crops, but a few areas are used for permanent pasture. Most of the acreage has been cleared and some has been drained. The main concerns in use of these soils for farming and for most other purposes is wetness in the Kilmanagh soils and erosion of the Grindstone soils. Flooding is common in lower areas in winter and spring.

If adequately drained, these soils have good potential for cultivated farm crops commonly grown in the county. Wetness and frost action are the major problems where these soils are used for building site development. The potential for such development is poor. The potential for development of wetland wildlife habitat is good on the poorly drained Kilmanagh soils.

4. Guelph-Londo-Parkhill

Nearly level to rolling, well drained to very poorly drained soils that formed in glacial till

This map unit is on till plains and moraines. Slopes are steeper along major drainageways and streams. They are generally short (fig. 3).

This map unit occupies about 11 percent of the county. About 30 percent is Guelph soils, 15 percent is Londo soils, 15 percent is Parkhill soils, and the remaining 40 percent is soils of minor extent. Guelph soils are in side slopes, Londo soils are in nearly level areas, and Parkhill soils are in drainageways and depressions.

Guelph soils are gently undulating or rolling and are moderately well or well drained. The surface layer typically is dark brown loam about 9 inches thick. The subsoil, about 12 inches thick, is dark brown and dark yellowish brown clay loam. The substratum is brown and dark brown loam to a depth of 60 inches.

Londo soils are nearly level and are somewhat poorly drained. The surface layer typically is very dark grayish brown loam about 9 inches thick. The subsoil is about 11 inches thick and is brown and yellowish brown, mottled

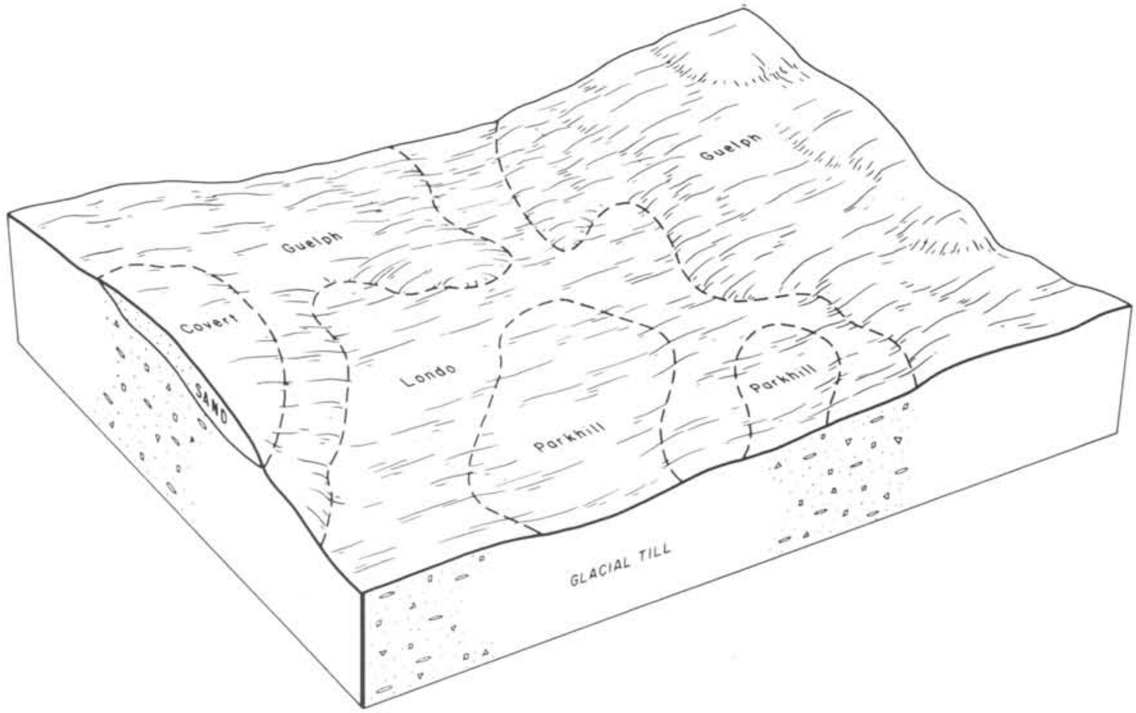


Figure 3.—Pattern of soils and underlying material in the Guelph-Londo-Parkhill map unit.

loam and clay loam. The substratum is brown, mottled loam till to a depth of 60 inches.

Parkhill soils are nearly level and are poorly drained or very poorly drained. The surface layer typically is very dark grayish brown loam about 9 inches thick. The subsoil, about 23 inches thick, is grayish brown mottled, friable loam. The underlying material, to a depth of about 60 inches, is grayish brown, mottled loam.

The minor soils in this map unit are the moderately well drained Covert loamy substratum soils and the very poorly drained Linwood and Pinnebog soils. Areas of the Covert loamy substratum soils are on sandy knolls throughout the map unit. The organic Linwood and Pinnebog soils are in depressional areas and potholes.

These soils are used mainly for cultivated crops, and the more sloping soils are in permanent pasture. Most of the acreage has been cleared, and some has been drained. Wetness in the Londo and Parkhill soils, erosion on Guelph and Londo soils, and slope of the Guelph soils, are the main concerns in farming and for most other uses of these soils. Also, flooding and ponding are common in the Parkhill soils in winter and spring.

If adequately drained, these soils have good potential for cultivated farm crops commonly grown in the county. Wetness and frost action in the Londo and Parkhill soils and slope of the Guelph soils are the major problems for most building and recreational developments. The potential for such developments is fair.

Nearly level to gently rolling soils that have a dominantly coarse textured surface layer and subsoil

Most of these soils have limited use as building sites and septic tank absorption fields because they are wet, but some soils have few limitations for these uses. Soil blowing is a concern on all the soils.

5. Covert-Plainfield-Tobico

Nearly level to moderately sloping, excessively drained, moderately well drained, poorly drained, and very poorly drained soils that formed in glacial drift

This map unit is on linear narrow dunes and swales. Slopes are steeper along streams and on a few of the larger dunes scattered throughout the map unit. All slopes are short.

This map unit occupies about 5 percent of the county. About 25 percent is Covert soils, 15 percent is Plainfield soils, 10 percent is Tobico soils, and the remaining 50 percent is soils of minor extent. Plainfield soils are on the highest ridges, Covert soils are on the lower ridges, and the Tobico soils are in swales.

Covert soils are nearly level or gently sloping and are moderately well drained. The surface layer typically is very dark grayish brown sand about 4 inches thick. The subsurface layer is light brownish gray sand about 6 inches thick. The subsoil, about 25 inches thick, is strong brown and brownish yellow loose sand. The substratum is light yellowish brown sand to a depth of about 60 inches.

Plainfield soils are gently sloping or moderately sloping and are excessively well drained. The surface layer typically is very dark brown sand about 1 inch thick. The subsoil, about 19 inches thick, is yellowish brown and brownish yellow loose sand. It is underlain by light yellowish brown sand to a depth of about 60 inches.

Tobico soils are nearly level and are poorly or very poorly drained. The surface layer typically is black and very dark gray mucky sandy loam about 8 inches thick. The calcareous subsoil, about 17 inches thick, is grayish brown loamy sand and sand. The substratum, to a depth of 60 inches, is brown gravelly sand and dark gray sand.

Minor soils in this map unit are the well drained Boyer soils, the somewhat poorly drained Pipestone soils, and the poorly drained and very poorly drained Belleville, Granby, and Adrian soils. Areas of the Pipestone and Granby soils, the loamy substratum Belleville soils, and the organic Adrian soils are closely intermingled with Tobico soils. Boyer soils are closely intermingled with the Covert and Plainfield soils.

These soils are used mainly for recreational purposes. Most of the acreage is forested, and there are many swampy undrained areas. The major limitations to use of these soils for farming and for most other purposes are high susceptibility to soil blowing, low available water capacity, low fertility, and difficulty in obtaining drainage outlets.

Potential is poor for the cultivated farm crops commonly grown in the county. Slope of the Plainfield soils and wetness of the Covert and Kingsville soils are the major problems to overcome when considering this unit for most building and recreational development. The potential for such development is fair.

6. Avoca-Pipestone-Covert

Nearly level or gently sloping, moderately well drained and somewhat poorly drained soils that formed in glacial drift

This map unit is on plains made up of isolated narrow beach ridges and broad, nearly level or gently sloping areas. Slopes are steeper around the more prominent ridges scattered throughout the map unit and along streams. They are generally short (fig. 4).

This map unit occupies about 10 percent of the county. About 35 percent is made up of Avoca soils, 15 percent is Pipestone soils, 10 percent is Covert soils, and 40 percent is minor soils. Covert soils in most places are slightly higher in elevation than the Avoca and Pipestone soils.

Avoca soils are nearly level and are somewhat poorly drained. The surface layer typically is very dark brown loamy sand about 4 inches thick. The subsurface layer is light brownish gray fine sand about 2 inches thick. The subsoil, about 18 inches thick, is dark brown and strong brown sand. The substratum is yellowish brown loam to a depth of about 60 inches.

Pipestone soils are nearly level to gently sloping and are somewhat poorly drained. The surface layer typically is black loamy sand about 2 inches thick, and the subsurface layer is light brownish gray sand about 8 inches thick. The subsoil, about 26 inches thick, is strong brown and brown sand. The substratum is light yellowish brown and pale brown sand to a depth of about 60 inches.

Covert soils are nearly level and are moderately well drained. The surface layer typically is very dark grayish brown sand about 4 inches thick, and the subsurface layer is light brownish gray sand about 6 inches thick. The subsoil, about 25 inches thick, is strong brown and brownish yellow sand. The substratum is light yellowish brown sand to a depth of about 60 inches.

Minor soils in this map unit are the poorly drained Kilmanagh and Corunna soils and the somewhat poorly drained Wasepi soils. Depressions and drainageways are occupied by the loamy Kilmanagh and Corunna soils. Areas of the Wasepi loamy substratum soils are closely intermingled with Avoca and Pipestone soils.

These soils are used mainly for cultivated crops, but a few scattered areas are used for permanent pasture and woodland. The main concerns of management are control of soil blowing, improving drainage, and maintaining fertility.

These soils have fair potential for most cultivated crops commonly grown in the county. Wetness is the major problem when considering these soils for building and recreational development. The potential for such development is poor.

7. Boyer-Tobico

Nearly level to gently rolling, well drained, poorly drained, and very poorly drained soils that formed in glaciofluvial sediments

This map unit is on narrow beach ridges and broad outwash plains. Slopes are mainly nearly level to gently rolling, but they are steeper around the more prominent ridges scattered throughout the map unit and along streams. All slopes are short.

This map unit occupies about 3 percent of the county. About 20 percent is Boyer soils, 20 percent is Tobico soils, and the remaining 60 percent is soils of minor

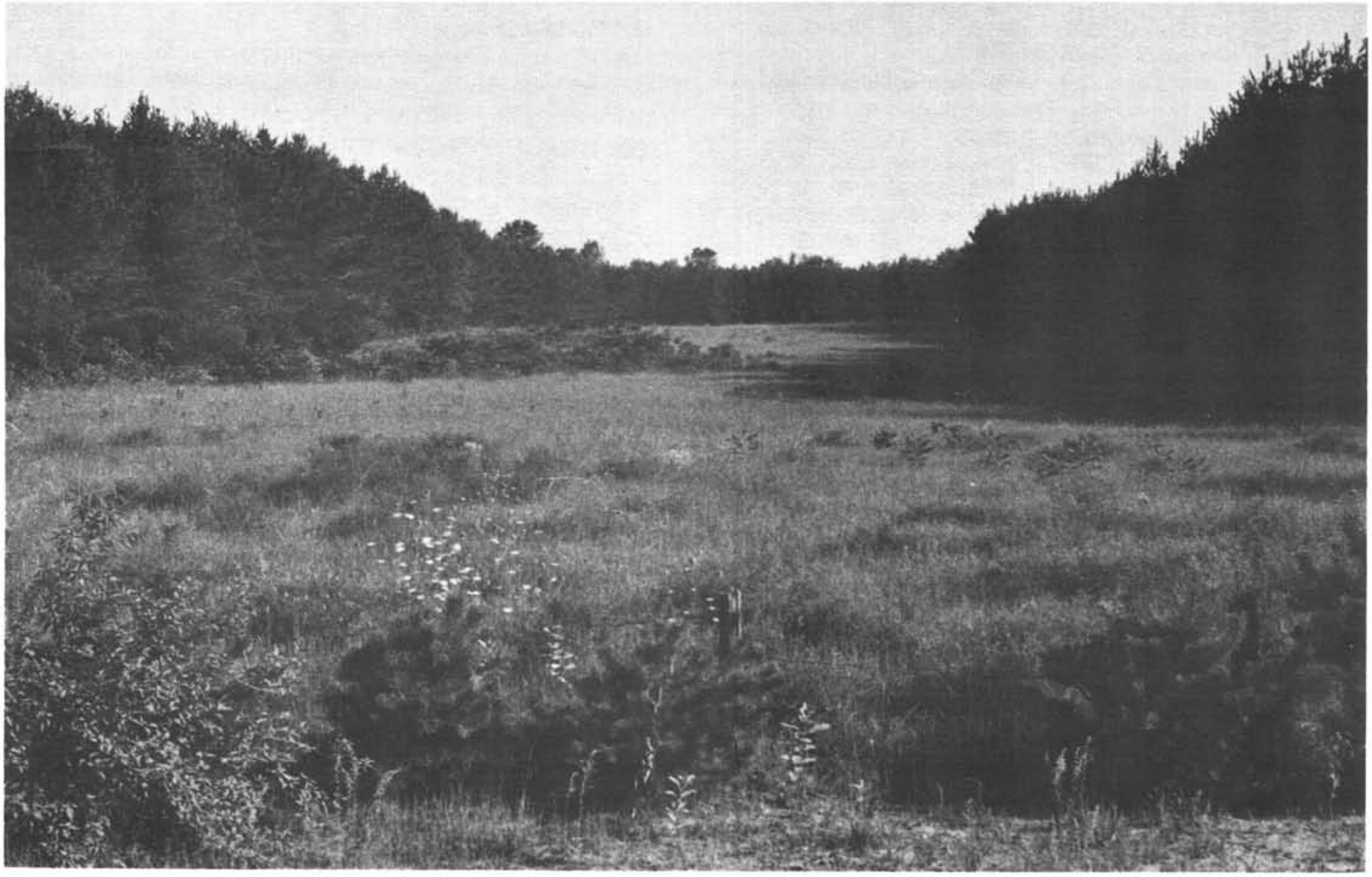


Figure 4.—Part of red pine plantation on soils of the Avoca-Pipestone-Covert map unit.

extent. Boyer soils occupy the hills and ridges, and Tobico soils are in depressional areas and drainageways.

Boyer soils are nearly level to gently rolling and are well drained. The surface layer typically is dark brown loamy sand about 7 inches thick. The subsoil is strong brown to brown sand, loam, and loamy sand. The substratum is light yellowish brown stratified sand and gravel to a depth of about 60 inches.

Tobico soils are nearly level and are poorly or very poorly drained. The surface layer is about 8 inches thick and typically is black and very dark gray mucky sandy loam. The calcareous subsoil, about 17 inches thick, is gray sandy loam and grayish brown loamy sand and sand. The substratum is brown gravelly sand and dark gray sand to a depth of about 60 inches.

Minor soils in this map unit are the poorly drained Corunna soils and the somewhat poorly drained Riverdale, Pipestone, and Badaxe soils. Areas of the loamy Corunna and Badaxe soils are closely intermingled with Tobico soils. Areas of the Riverdale and Pipestone soils are closely intermingled with Boyer soils.

This map unit has poor potential for cultivated crops. The main concerns of management are control of soil blowing, improvement of drainage in Tobico soils, and maintaining fertility and establishment of irrigation for Boyer soils when feasible. Much of the map unit is wooded or idle, but some areas are used for cultivated crops or permanent pasture.

Potential is poor for most cultivated crops commonly grown in the county. Some areas of Boyer soils are sources of gravel for road construction. The potential for building site development of the Boyer soils is good. Wetness and flooding are problems to overcome when considering Tobico soils for this development. The potential for development of wetland wildlife habitat is fair on Tobico soils.

Nearly level, calcareous soils that have a medium textured surface layer and subsoil

The soils in this group range from somewhat poorly drained to very poorly drained. Their use as building sites and septic tank absorption fields is limited by wetness.

8. Sanilac-Bach

Nearly level, somewhat poorly drained, poorly drained, and very poorly drained soils that formed in lacustrine sediments

This map unit is on a nearly level lake plain made up of broad level areas, drainageways, and divides. Slopes are short.

This map unit occupies about 4 percent of the county. About 35 percent of the map unit is Sanilac soils, 20 percent is Bach soils, and 45 percent is minor soils. Sanilac soils are on the slightly higher rounded swells and drainage divides. The Bach soils are in depressional areas and drainageways.

Sanilac soils are nearly level and are somewhat poorly drained. The surface layer typically is dark grayish brown calcareous silt loam about 13 inches thick. The subsoil, about 11 inches thick, is pale brown and brown very fine sandy loam. The substratum, to a depth of 60 inches, is pale brown, stratified very fine sandy loam and loamy very fine sand.

Bach soils are nearly level and are poorly drained or very poorly drained. The surface layer typically is very dark grayish brown calcareous silt loam about 10 inches thick. The subsoil is light brownish gray very fine sandy loam about 20 inches thick. The substratum, to a depth of about 60 inches, is pale brown and brown, stratified loamy very fine sand to silt loam.

Minor soils in this map unit are the poorly drained Kilmanagh soils, the moderately well drained Grindstone and Gagetown soils, and the somewhat poorly drained Shebeon soils. Areas of the nonstratified Kilmanagh soils are closely intermingled with Bach soils. The Grindstone and Gagetown soils are on the more pronounced knolls and divides. Areas of the nonstratified Shebeon soils are closely intermingled with Sanilac soils.

These soils are used mainly for cultivated crops. The main concerns of management are improvement of drainage, maintaining soil tilth and fertility, and control of water erosion.

These soils have good potential for all cultivated crops commonly grown in the county. The potential for building and recreational development is poor because of wetness and flooding in low lying areas. The potential for wetland wildlife habitat is good on the Bach soils.

9. Tappan

Nearly level, poorly drained soil that formed in glacial till

This map unit is on till plains. It occupies about 4 percent of the county. About 55 percent of the map unit is Tappan soils and the remaining 45 percent is soils of minor extent.

Tappan soils are nearly level and are poorly drained. The surface layer typically is very dark grayish brown, calcareous loam about 13 inches thick. The subsoil, about 18 inches thick, is light brownish gray to dark yellowish brown loam and silt loam and gray loam. The substratum is yellowish brown loam to a depth of 60 inches.

Minor soils in this map unit are the somewhat poorly drained Shebeon and Avoca soils, the poorly or very poorly drained Bach and Essexville soils, and the poorly drained Kilmanagh soils. Scattered raised areas are occupied by the Shebeon soils. Sandy ridges throughout the unit are occupied by the Avoca soils. Areas of the stratified Bach soils, the noncalcareous Kilmanagh soils, and the sandy Essexville soils are closely intermingled with areas of the Tappan soils.

These soils are used mainly for cultivated crops. Most of the acreage has been cleared and drained, but there are some swampy undrained areas. Wetness is the main limitation to farming and for most other purposes. Also, flooding and ponding are common in winter and spring.

If adequately drained, these soils have good potential for cultivated farm crops commonly grown in the county. Because wetness is a severe problem and difficult to overcome, the potential for building and recreational development is poor. The potential for development of wetland wildlife habitat is good.

Broad land use considerations

Huron County is a rural county that is more than 90 percent farmland. The major land use is the growing of cultivated crops. Much of this farmland has been drained, and it includes some of the best farmland in the State. The loamy, nearly level soils of the Shebeon-Kilmanagh map unit, which have good potential for farming, cover well over half of the county. Other map units that have good potential for farming are units 3, 4, 8, and 9 on the general soil map. Some of the dominant soils in these map units are Grindstone, Tappan, Sanilac, and Bach soils. Wetness is the major limitation to nonfarm uses of these soils. With proper drainage, it can be controlled.

The soils in map units 5, 6, and 7 have fair potential for farming. These soils are sandy and subject to soil blowing. Soil wetness, low fertility, and low available water capacity are additional problems that need to be overcome. Soils in the Aubarque-Filion map unit also have only fair potential for farming because they are shallow to firm loam till which can impede drainage.

Soils of the Grindstone-Kilmanagh map unit and less sloping areas of the Guelph-Londo-Parkhill map unit are well suited to nurseries. Guelph and Grindstone soils are well drained and moderately well drained, and they warm early in spring. The sandy soils of the Avoca-Pipestone-Covert map unit are well suited to small fruits and truck crops grown under irrigation.

Most of the map units in the county have good or fair potential for woodland. Commercially valuable trees are rare on many of the soils because the soils are wet. The wet soil causes slow growth, low survival, and poor regeneration of seedlings. The better drained sandy soils of the Covert-Plainfield-Tobica and Avoca-Pipestone-Covert map units produce trees that are suitable for pulp or low grade lumber.

Areas suitable as building sites are not extensive in the county. The well drained, less sloping areas of the Boyer-Tobico and Guelph-Londo-Parkhill map units have the best potential for building development. The major problems that need to be controlled when building on soils of the Shebeon-Kilmanagh, Grindstone-Kilmanagh, Aubarque-Filion, Sanilac-Bach, and Tappan map units are soil wetness, restricted permeability, and high potential frost action. The sandy soils of the Avoca-Pipestone-Covert map unit are poor potential building sites because they are seepy and wet.

Dune areas of the Covert-Plainfield-Tobico map unit, which surround the county, are excellent potential sites for parks and extensive recreation areas. The lower, wetter, undrained areas in all map units are mostly wooded or brushy and grow wetland grasses, reeds, and sedges. These areas provide suitable vegetation and cover for various species of wildlife.

Soil maps for detailed planning

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

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

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

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

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

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

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Riverdale-Pipestone complex, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Aquents and Histosols, ponded, is an undifferentiated group in this survey area.

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

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

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

Soil descriptions

3A—Shebeon loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flats and low knolls and in drainageways. Individual areas of this soil are irregular or linear in shape and range from 4 to several thousand acres.

Typically, the surface layer is dark brown loam about 11 inches thick. The subsoil is mottled, firm clay loam about 12 inches thick. The upper part is yellowish brown

The lower part is grayish brown. The substratum, to a depth of 60 inches, is firm grayish brown and very firm yellowish brown mottled loam. In some places clay has not accumulated in the subsoil. In some areas the depth to very firm material is more than 40 inches.

Included with this soil in mapping are small areas of poorly drained Kilmanagh soils and somewhat poorly drained Avoca soils (fig. 5). The Kilmanagh soils are in shallow depressions and drainageways. The Avoca soils are coarser textured than the Shebeon soil and are throughout the unit. Also included are small areas of calcareous Aubarque and Sanilac soil. A few small areas in which bedrock is at a depth of less than 60 inches are throughout the map unit.

Permeability of the Shebeon soil is moderately slow in the upper part of the profile and very slow in the lower part. The Shebeon soil has moderate available water capacity and medium or slow runoff. In undrained areas the water table is perched within 1 to 2 feet of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated. It has good potential for cultivated crops and pasture. It has poor potential for sanitary facilities and building sites.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness. However, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Figure 5.—Somewhat poorly drained Shebeon soils in background contrast with darker, poorly drained Kilmanagh soils in foreground.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent seedling emergence and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by very slow permeability in the substratum. Artificial drainage helps control the high water table. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 2.5b-d.

4B—Grindstone loam, 0 to 4 percent slopes. This nearly level and gently undulating, moderately well drained soil is on flats, low knolls, and in areas adjacent to drainageways and low ridges. Individual areas are irregular in shape and range from 4 to several hundred acres.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The subsoil is mottled and about 18 inches thick. The upper part is yellowish brown, friable clay loam. The next part is brown, firm clay loam. The lower part is light yellowish brown, friable silt loam. The substratum, to a depth of about 60 inches, is brown, mottled very firm loam. In some areas the depth to very firm material is more than 40 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Shebeon and Avoca soils. They are in depressions and narrow drainageways. Also included are moderately well drained Gagetown soils which are coarser textured and have a higher percentage of silt and very fine sand than the Grindstone soils. They are interspersed throughout the unit. A few small areas in which bedrock is at a depth of less than 60 inches are throughout the map unit.

Permeability of the Grindstone soil is moderate in the upper part of the profile and very slow in the lower part.

The Grindstone soil has moderate available water capacity and medium or slow runoff. In undrained areas the water table is perched within 1 1/2 to 3 feet of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated. It has good potential for cultivated crops and pasture. It has fair to poor potential for recreation. It has fair potential for sanitary facilities and building sites.

This soil is suited to the cultivated crops commonly grown in this area. Limited rooting depth, wetness, water erosion, and soil compaction are the major concerns. Wetness can be controlled by combined surface and subsurface drainage systems. Generally, only low areas and drainageways need tile drainage, but some nearly level areas may need a grid system of tile drainage if cash crops are to be grown. Erosion can be controlled by cover crops, grassed waterways, residue management, and good crop rotation using minimum tillage or no-till planting. Erosion control structures may be needed where natural drainageways enter ditches.

Compacted soils inhibit root development and reduce crop yields. Working this soil when it is too wet results in a cloddy, compacted soil. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the growth of seedlings and increase runoff and erosion. Minimum tillage or no-till planting, cover crops, returning crop residues to the soil, and the regular addition of organic matter will minimize compaction and help maintain soil tilth.

The use of this soil for pasture is effective in controlling erosion. However, overgrazing or grazing when the soil is too wet will cause surface compaction, excessive runoff, and erosion. Proper stocking and rotational or strip grazing help to keep the pasture and soil in good condition.

Most areas of this soil can be developed for recreation. Playgrounds should be developed in less sloping areas and protected with a good sod cover. Paths and trails are easy to make and maintain. Drainageways or depressions should be avoided for campsites and picnic areas.

This soil can generally be used as building sites. The major limitations are the seasonal high water table and very slow permeability in the substratum. Artificial drainage helps control the high water table. Basements should be carefully designed to prevent the entry of water. The effects of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIs; Michigan soil management group 2.5a-d.

5—Kilmanagh loam. This nearly level, poorly drained soil is on flats and in depressions and drainageways. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to several thousand acres.

Typically, the surface layer is very dark gray loam about 9 inches thick. The subsoil is mottled, friable loam about 20 inches thick. The upper part is gray. The lower part is dark yellowish brown. The mottled substratum, to a depth of 60 inches, is dark yellowish brown, friable loam and brown, very firm loam. In some places the soil is calcareous within 10 inches of the surface. In some areas the depth to very firm material is more than 50 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Shebeon and Badaxe soils on slight knolls. Also included throughout the map unit are areas of the poorly drained Corunna soils which are coarser textured than the Kilmanagh soils and a few small areas in which bedrock is at a depth of less than 60 inches.

Permeability of the Kilmanagh soil is moderate in the upper part of the profile and very slow in the lower part. The Kilmanagh soil has moderate available water capacity and slow to ponded runoff. In undrained areas the water table is perched within 1 foot of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated. It has good potential for cultivated crops and pasture. It has poor potential for sanitary facilities and building sites.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness. However, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where the surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in a cloddy, compacted soil. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants.

Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table, by flooding, and by the very slow permeability in the substratum. Artificial drainage helps control the high water table and flooding. Houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 2.5c.

6A—Avoca loamy sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flats, low knolls, and low ridges. Individual areas are irregular or linear in shape and range from 4 to several hundred acres.

Typically, the surface layer is very dark brown loamy sand about 4 inches thick. The subsurface layer is light brownish gray fine sand about 2 inches thick. The subsoil is mottled, loose sand about 18 inches thick. It is dark brown in the upper part and strong brown in the lower part. The mottled substratum, to a depth of 60 inches, is yellowish brown sand and yellowish brown loam. In some places precipitated iron, aluminum, and organic matter have not accumulated in the soil. In some places there is a layer of clay accumulation in the subsoil. In some areas there is less than 20 inches, and in some other areas more than 40 inches, of sandy soil over loamy soil.

Included with this soil in mapping are small areas of poorly drained Kilmanagh and somewhat poorly drained Shebeon and Badaxe soils which are finer textured than the Avoca soils. They are interspersed throughout the unit. Also included are areas of poorly drained and very poorly drained Belleville soils in depressions and drainageways.

Permeability of the Avoca soil is rapid in the upper part of the profile and moderately slow in the lower part. The Avoca soil has moderate available water capacity and slow or very slow runoff. In undrained areas the water table comes to within 1 to 2 feet of the surface during the winter and spring months.

Most areas of this soil are cultivated or are in woodland. Potential is fair for cultivated crops and woodland. It is good for pasture. It is fair for openland, woodland, and wetland wildlife. It is poor for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness, soil blowing, and maintaining the level of organic matter are the major concerns.

Combined surface and subsurface drainage systems help control wetness. However, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

This soil is often droughty in summer. Irrigation will increase production. Tree windbreaks, rye buffer strips, cover crops, and residue management can help control soil blowing. No-till planting is possible on this soil.

A good rotation, returning crop residues to the soil, and regular addition of other organic matter help maintain or increase the level of organic matter. This will improve soil fertility and increase the water available for plants.

Undrained areas are sometimes used for pasture. During the summers when this soil often lacks sufficient moisture, overgrazing may result in soil blowing. Proper stocking, rotational or strip grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is often wooded but is seldom managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. Planting more seedlings than necessary will help compensate for high seedling mortality. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil can support wildlife if a moderate level of management is used. Woodland wildlife can usually find adequate food and cover. Berry-producing shrubs can be planted along fence rows for openland wildlife. Habitat for wetland wildlife can be improved by digging shallow ponds.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by moderately slow permeability in the substratum. Artificial drainage helps control the high water table; however, houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIIw; Michigan soil management group 4/2b.

7A—Aubarque loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flats and low knolls (fig. 6). Individual areas are irregular in shape and range from 4 to several hundred acres.

Typically, the surface layer is dark grayish brown, calcareous loam about 12 inches thick. The subsoil is about 5 inches thick. It is yellowish brown, mottled, friable loam. The substratum, to a depth of 60 inches, is mottled, brown and pale brown, very firm loam and brown and reddish brown, extremely firm loam. In some areas the soil is not calcareous within 10 inches of the surface. The upper part of some profiles is stratified silt loam and very fine sandy loam. In some places depth to the very firm substratum is more than 24 inches.

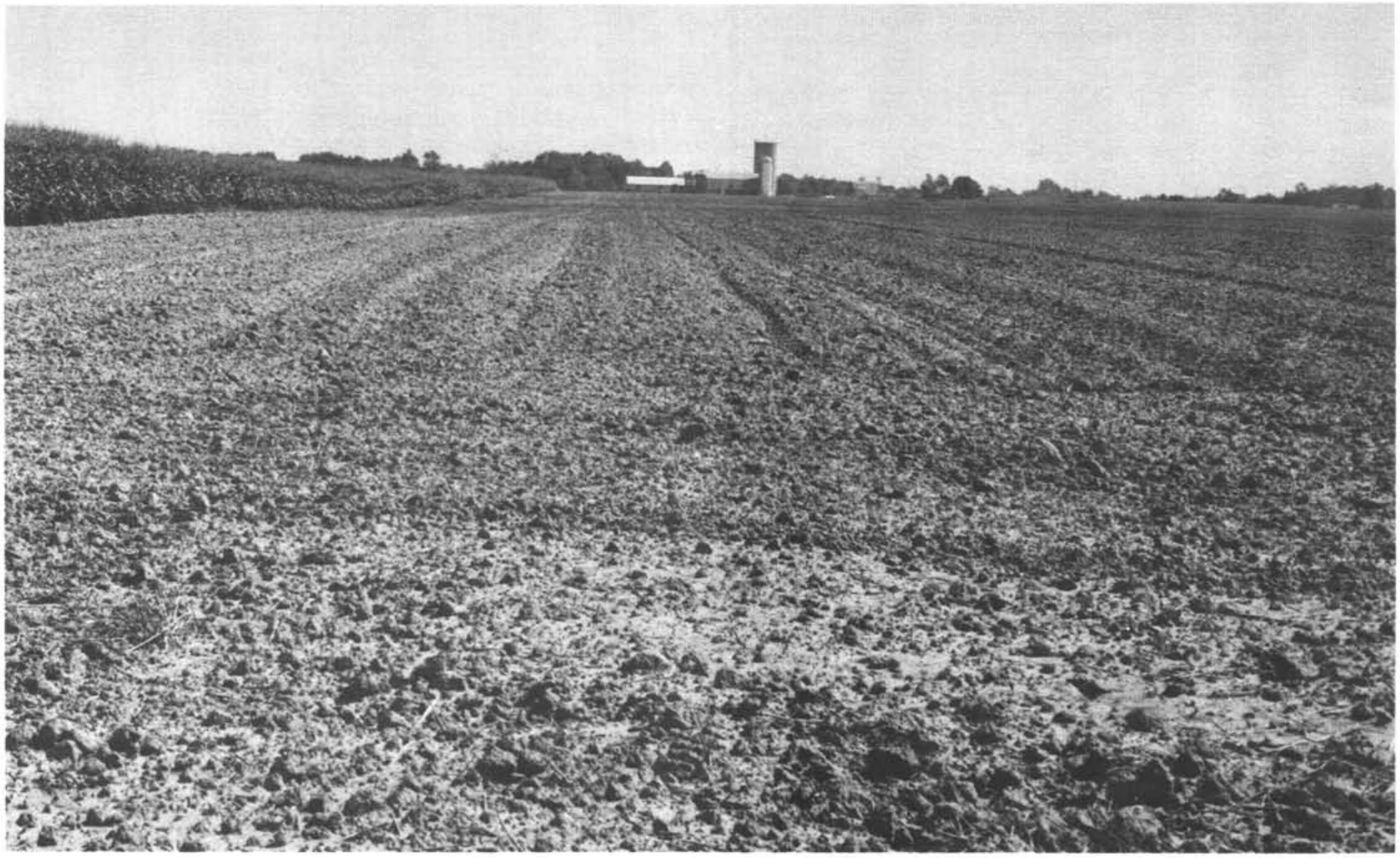


Figure 6.—Typical area of Aubarque loam.

Included with this soil in mapping are small areas of moderately well drained Grindstone soils on knolls and bordering drainageways. Also included are poorly drained Kilmanagh soils in depressions and drainageways. A few small areas of coarse textured Avoca soil and areas in which bedrock is at a depth of less than 60 inches are throughout the map unit.

Permeability of the Aubarque soil is moderate in the upper part of the profile and very slow in the lower part. The Aubarque soil has low available water capacity and medium runoff. In undrained areas the water table is perched within 1/2 to 1 1/2 feet of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated. It has fair potential for cultivated crops and good potential for pasture. It has fair to poor potential for recreational uses. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness, very slow permeability, and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness. The very slowly permeable and shallow substratum of this soil may make tile drainage less effective. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Most areas of this soil can be developed for recreation if managed properly. This soil has a seasonal high water table. Use may need to be restricted during the winter and spring and after heavy rains.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by very slow permeability in the substratum. Artificial drainage helps control the high water table. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capbility subclass IIIw; Michigan soil management group 2.5b-cd.

7B—Aubarque loam, 2 to 6 percent slopes. This gently sloping, somewhat poorly drained soil is in drainageways which dissect broad flat areas. Individual areas are linear or winding in shape and range from 4 to 200 acres.

Typically, the surface layer is dark brown, calcareous loam about 8 inches thick. The subsoil is about 3 inches thick. It is brown, mottled, friable loam. The mottled substratum, to a depth of about 60 inches, is pale brown and brown, very firm loam. In some areas the surface layer is not calcareous. The upper part of some profiles is stratified silt loam and very fine sandy loam. In some places the depth to the very firm substratum is more than 24 inches.

Included with this soil in mapping are small areas of moderately well drained Grindstone soils on knolls and bordering drainageways. Also included are poorly drained Kilmanagh soils in depressions and drainageways.

Permeability of the Aubarque soil is moderate in the upper part of the profile and very slow in the lower part. The Aubarque soil has low available water capacity and medium runoff. In undrained areas the water table is perched within 1/2 to 1 1/2 feet of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated. It has fair potential for cultivated crops and good potential for pasture. It has fair to poor potential for recreational uses. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness, water erosion, and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control the wetness. Because areas of this soil are small, the surrounding soils must be considered in planning a drainage system. Erosion control structures may be needed where natural drainageways enter ditches. Cover crops, grassed waterways, residue management, and a good crop rotation using minimum tillage help to prevent erosion.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting also becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Most areas of this soil can be developed for recreation if managed properly. Because this soil has a seasonal high water table, use may need to be restricted during winter and spring and after heavy rains.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by very slow permeability in the substratum. Artificial drainage helps control the high water table. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of soil with a suitable base material.

This soil is in capability subclass IIIe; Michigan soil management group 2.5b-cd.

9B—Plainfield sand, 0 to 6 percent slopes. This nearly level and gently undulating, excessively drained soil is on flats, low ridges, and low knolls. Individual areas are irregular or linear in shape and range from 4 to more than 100 acres.

Typically, the surface layer is dark grayish brown sand about 9 inches thick. The subsoil is loose sand about 18 inches thick. The upper part is dark brown. The lower part is yellowish brown. The substratum, to a depth of about 60 inches, is light yellowish brown sand. In some places, precipitated iron, aluminum, and organic matter have accumulated in the soil. In some places the soil has a layer of clay accumulation in the subsoil.

Included with this soil in mapping are small areas of moderately well drained Covert soils and Covert loamy substratum soils. They are in depressions.

Permeability of the Plainfield soil is rapid. The Plainfield soil has very low available water capacity and slow runoff.

Most areas of this soil are cultivated or are in woodland. Potential is poor for cultivated crops and fair for recreational uses. It is good for woodland and poor for wildlife. It is good for sanitary facilities and building site development.

Cultivated crops are not usually grown on this soil because of droughtiness, low fertility, and susceptibility to soil blowing. Crops often dry up in summer and are not harvestable.

This soil is often in woodland but is seldom managed for this use. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will regenerate without planting. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil can support wildlife if managed carefully. Woodland wildlife habitat can be improved by planting most trees for food and coniferous trees for cover. Planting berry-producing shrubs along fence rows will encourage openland wildlife. Digging shallow ponds in low areas will attract wetland wildlife; however, they may dry up in summer.

Most areas of this soil can be developed for recreation if protected from soil blowing. The grass cover is usually sparse. Wood chips can be used where foot traffic is heavy. Playgrounds should be developed in the less sloping areas. If loamy topsoil is added, a good sod cover can be established. Large open areas can be protected by tree windbreaks. Trails are easy to make and maintain.

This soil can be used as building sites. Because the soil is rapidly permeable, its use for septic tank absorption fields may cause pollution of the ground water.

This soil is in capability subclass VIs; Michigan soil management group 5.3a.

9C—Plainfield sand, 6 to 12 percent slopes. This gently rolling, excessively drained soil is on low ridges and knolls. Individual areas are irregular in shape and range from 4 to 200 acres.

Typically, a thin layer of matted leaves, twigs, and mixed sand and organic matter covers the surface layer. The surface layer is very dark gray sand about 1 inch thick. The subsurface layer is brown sand about 3 inches thick. The subsoil is loose sand about 16 inches thick. The upper part is yellowish brown. The lower part is brownish yellow. The substratum, to a depth of about 60 inches, is light yellowish brown stratified sand and fine sand. In some places, precipitated iron, aluminum, and organic matter have accumulated in the soil.

Included with this soil in mapping are small areas of a steeper soil.

The Plainfield soil has rapid permeability, very low available water capacity, and medium runoff.

Most areas of this soil are in woodland. Potential is poor for cultivated crops and wildlife. It is good for woodland and fair for recreational uses other than playgrounds. It is fair for sanitary facilities and as building sites.

Cultivated crops are not generally grown on this soil because of droughtiness, low fertility, and susceptibility to wind and water erosion. Crops often dry up during the summer and are not harvestable.

This soil is mostly in woodland but is seldom managed for this use. Many stands are understocked. Diseased, crooked, and forked trees should be harvested and the better trees saved. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil can support wildlife if managed carefully. Woodland wildlife habitat can be improved by planting mast trees for food and coniferous trees for cover. Planting berry-producing shrubs along fence rows will encourage openland wildlife.

This soil can be developed for recreational areas other than playgrounds. The grass cover is usually sparse. Wood chips can be used where foot traffic is heavy. Large open areas can be protected with tree windbreaks. Trails are easy to make and maintain. Some land shaping may be necessary for campsites and picnic areas.

This soil can generally be used as building sites. The major concern is slope. It can be corrected by land forming and placing local roads and streets on the contour. Because it is rapidly permeable, use of this soil for septic tank absorption fields may pollute the ground water.

This soil is in capability subclass VIs; Michigan soil management group 5.3a.

11A—Covert sand, loamy substratum, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on low ridges, flats, and low knolls. Individual areas are linear or irregular in shape and range from 4 to 200 acres.

Typically, the surface layer is dark grayish brown sand about 10 inches thick. The subsoil is loose sand about 16 inches thick. The upper part is dark brown. The lower part is strong brown. The substratum, to a depth of 60 inches, is light yellowish brown, mottled sand and brown loam. In some places precipitated iron, aluminum, and organic matter have not accumulated in the soil. In some places, a layer of clay accumulation is in the subsoil. In some areas there is less than 40 inches or more than 60 inches of sandy soil over the loamy soil.

Included with this soil in mapping are small areas of somewhat poorly drained Avoca and Pipestone soils.

Permeability of the Covert loamy substratum soil is rapid in the upper part of the profile and moderately slow or slow in the lower part. The available water capacity is low, and runoff is very slow. In undrained areas the water table is within 1 1/2 to 3 1/2 feet of the surface during the winter and spring months.

Most areas of this soil are cultivated or are in woodland. It has fair potential for cultivated crops and recreational uses. It has good potential for pasture and woodland. It has poor potential for wildlife. It has fair potential for sanitary facilities and building site development.

This soil is suited to growing small grains, corn, grasses, and legumes. Droughtiness, soil blowing, and maintaining the level of organic matter are the major concerns.

This soil is often droughty in the summer, but irrigation will increase production. Using a good crop rotation, returning crop residues to the soil, and the regular addition of other organic matter will help maintain or increase the content of organic matter. This, in turn, will improve soil fertility and increase the water available to plants. Low areas and drainageways are wet in the spring and may need artificial drainage. Tree windbreaks, rye buffer strips, cover crops, and residue management help stop soil blowing. No-till planting can be used.

The use of this soil for pasture is effective in controlling erosion. During the summer, when this soil often lacks sufficient moisture, overgrazing may result in soil blowing. Proper stocking, rotational or strip grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is often in woodland but is seldom managed for this use. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will regenerate without planting. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil can support wildlife if managed carefully. Woodland wildlife habitat can be improved by planting mast trees for food and coniferous trees for cover. Planting berry-producing shrubs along fence rows will encourage openland wildlife. Digging shallow ponds in low areas will attract wetland wildlife; however, they may dry up during the summer.

Most areas of this soil can be developed for recreation. The grass cover is usually sparse. Wood chips can be used where foot traffic is heavy. Large open areas can be protected by tree windbreaks. Trails are easy to make and maintain.

This soil can usually be used as building sites. The major concern is the seasonal high water table. Artificial drainage will control the high water table. Basements should be carefully designed to prevent entry of water.

This soil is in capability subclass IVs; Michigan soil management group 5/2a.

12A—Sanilac silt loam, 0 to 3 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on flats and low knolls. Individual areas are irregular in shape and range from 4 to several hundred acres.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 13 inches thick. The subsoil is about 12 inches thick. It is pale brown and brown, mottled, friable very fine sandy loam. The substratum, to a depth of 60 inches, is stratified, pale brown, mottled very fine sandy loam and loamy very fine sand. In some places the soil is not calcareous within 10 inches of the surface. In some places the lower part of the substratum is loam.

Included with this soil in mapping are small areas of poorly drained Bach soils and moderately well drained Gagetown soils. The Bach soils are in depressions and drainageways and the Gagetown soils are on knolls. A few small areas of an Avoca soil that is coarser textured in the surface layer and subsoil are throughout the map unit.

The Sanilac soil has moderately slow or moderate permeability, available water capacity is high, and runoff is slow. In undrained areas the water table is within 1 to 2 feet of the surface during the winter and spring months. The surface layer contains free lime, which may cause manganese deficiency in sugar beets, beans, oats, and barley or zinc deficiency in corn and beans.

Most areas of this soil are cultivated. It has good potential for cultivated crops and pasture. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table. Artificial drainage helps control the high water table and flooding. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 2.5b-cs.

13B—Gagetown silt loam, 0 to 4 percent slopes. This nearly level and gently undulating, moderately well drained soil is on flats, low ridges, and low knolls. Individual areas are irregular in shape and range from 4 to 200 acres.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is dark yellowish brown, mottled, friable silt loam about 3 inches thick. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, stratified very fine sand to silt loam. In some places the subsoil has a layer of clay accumulation. In some areas the lower part of the substratum is loam.

Included with this soil in mapping are small areas of somewhat poorly drained Sanilac soils. They are in depressions and drainageways. Also included throughout the map unit, are areas of somewhat poorly drained Avoca soil.

The Gagetown soil has moderate or moderately slow permeability, moderate available water capacity, and medium or slow runoff. In undrained areas the water table is within 2 to 3 feet of the surface during the winter and spring months.

Most areas of this soil are cultivated. It has good potential for cultivated crops, pasture, and recreational uses. It has fair to poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Water erosion, wetness, and soil compaction are the major concerns.

Cover crops, grassed waterways, residue management, and a good rotation using minimum tillage or no-till planting help to prevent erosion. Erosion control structures may be needed where natural drainageways enter ditches.

Combined surface and subsurface drainage systems help control wetness. Generally, only low areas and drainageways need tile drainage, but some nearly level areas may need a grid system of tiles if cash crops are to be grown.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage or no-till planting, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

The use of this soil for pasture is effective in controlling erosion. However, overgrazing or grazing when the soil is too wet will cause surface compaction, excessive runoff, and erosion. Proper stocking and rotational or strip grazing help to keep the pasture and soil in good condition.

Most areas of this soil can be developed for recreation. Playgrounds should be developed in the less sloping areas and protected with a good sod cover. Paths and trails are easy to make and maintain. Drainageways or depressions should be avoided for campsites and picnic areas.

This soil can generally be used as building sites. The major limitation is the seasonal high water table. Artificial drainage helps control the high water table. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of soil with a suitable base material.

This soil is in capability subclass IIe; Michigan soil management group 2.5a-cs.

14A—Badaxe fine sandy loam, 0 to 3 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on flats, low knolls, and low ridges. Individual areas are irregular or linear in shape and range from 4 to 200 acres.

Typically, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 17 inches thick. The upper part is brown, very friable loamy sand; the middle part is dark yellowish brown, mottled, friable loam; the lower part is dark yellowish brown, mottled, very friable sandy loam. The mottled substratum, to a depth of 60 inches, is firm and very firm brown loam. In some places clay has not accumulated in the subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Avoca soils and poorly drained Corunna and Kilmanagh soils. The Avoca soils are coarser textured than the Badaxe soil and are throughout the map unit. The poorly drained Corunna and Kilmanagh soils are in depressions and drainageways. In a few small areas, bedrock is at a depth of less than 60 inches.

Permeability of the Badaxe soil is moderate in the upper part of the profile and very slow in the lower part. The Badaxe soil has moderate available water capacity and medium or slow runoff. In undrained areas the water table is perched within 1 to 2 feet of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated or are in woodland. It has good potential for cultivated crops, pasture, and woodland. It has good potential for openland and woodland wildlife. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Working this soil when too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Much of this soil is wooded, but little of it is managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil provide good habitat for woodland wildlife. Planting berry-producing shrubs along fence rows will attract openland wildlife.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by very slow permeability in the substratum. This soil is highly susceptible to frost action. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 3/2b-d.

15B—Deerton Variant gravelly loamy sand, 0 to 4 percent slopes. This moderately deep, nearly level and gently sloping soil is moderately well drained or well drained. It is on low ridges and low knolls. Individual areas are linear or irregular in shape and range from 4 to 200 acres.

Typically, the surface layer is black gravelly loamy sand about 3 inches thick. The subsurface layer is brown gravelly coarse sand about 2 inches thick. The subsoil is about 17 inches thick. The upper part is dark brown, very friable gravelly loamy sand; the lower part is brown, loose very cobbly coarse sand. Sandstone bedrock is at a depth of about 22 inches.

In some places, precipitated iron, aluminum, and organic matter have not accumulated in the soil. In some places there is a layer of clay accumulation in the subsoil. In some areas there is less than 20 inches or more than 40 inches of sandy soil over the bedrock.

Included with this soil in mapping are small areas of somewhat poorly drained Tyre and Mitiwanga soils. They are in depressions.

Permeability of the Deerton Variant soil is rapid or moderately rapid above the bedrock. The available water capacity is very low, and runoff is very slow. In undrained areas the water table is perched within 1 1/2 to 3 1/2 feet of the surface during the winter and spring months. The rooting depth is restricted by bedrock.

Most areas of this soil are cultivated or are in woodland. It has fair potential for cultivated crops and woodland. It has good potential for pasture. It has poor potential for wildlife and recreational uses. It has fair potential for building development and poor potential for septic tank absorption fields.

This soil is suited to small grains, corn, grasses, and legumes. Most areas have enough cobbles and stones to make seedbed preparation and harvesting difficult. If the cobbles and stones are removed, crop yields will improve and wear on equipment will decrease. Soil blowing and water erosion, and maintaining the level of organic matter are also major concerns.

Low areas and drainageways are wet in spring and may need artificial drainage. Drainage tile may be difficult to install because of the moderate depth to bedrock. Tree windbreaks, rye buffer strips, cover crops, grassed waterways, residue management, and a good crop rotation using minimum tillage or no-till planting will help control erosion. This soil is often droughty in the summer. Irrigation will increase production.

A good system of crop rotation, returning crop residues to the soil, and the regular addition of organic matter will help maintain or increase the level of organic matter. This will improve soil fertility and increase the water available for plants.

The use of this soil for pasture is effective in controlling erosion. During the summer, when this soil often lacks sufficient moisture, overgrazing may result in soil blowing. Proper stocking, rotational or strip grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is often in woodland but is seldom managed for this use. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will regenerate without planting. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil can support wildlife if managed carefully. Woodland wildlife habitat can be improved by planting mast trees for food and coniferous trees for cover. Berry-producing shrubs planted along fence rows will encourage openland wildlife. Shallow ponds in low areas will attract wetland wildlife but may dry up during the summer.

Most areas of this soil can be developed for recreation. The grass cover is usually sparse. Wood chips can be used where foot traffic is heavy. Large open areas can be protected with tree windbreaks. Trails are easy to make and maintain.

This soil can generally be used as building sites. The major limitations are the seasonal high water table and bedrock at a depth of 20 to 40 inches. The bedrock is shallow enough to limit the effectiveness of septic tank absorption fields. Cracks in the rock may allow pollution of ground water. Artificial drainage will help control the high water table.

This soil is in capability subclass IVs; Michigan soil management group 4/Ra.

18—Tappan loam. This nearly level, poorly drained soil is on flats and in depressions and drainageways. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to several thousand acres.

Typically, the surface layer is very dark grayish brown, calcareous loam about 13 inches thick. The mottled subsoil is about 18 inches thick. The upper part is light brownish gray to dark yellowish brown, friable loam and silt loam; the lower part is gray, firm loam. The substratum, to a depth of about 60 inches, is yellowish brown, mottled loam. In some places the soil is not calcareous within 10 inches of the surface. In some areas there is very firm soil in the substratum.

Included in mapping are small areas throughout the map unit of somewhat poorly drained Avoca soils, poorly drained and very poorly drained Belleville soils, and very poorly drained Aurelius soils. The Avoca and Belleville soils are coarser textured than the Tappan soils. The Aurelius soils have a muck surface layer underlain by marl. A few small areas in which bedrock is at a depth of less than 60 inches are interspersed throughout the unit.

Permeability of the Tappan soil is moderate or moderately slow in the upper part of the profile and slow in the lower part. The Tappan soil has high available water capacity and slow or ponded runoff. In undrained areas the water table is perched within 1 foot of the surface during the winter and spring months. The surface layer contains free lime. This may cause manganese deficiency in sugar beets, beans, oats, and barley and zinc deficiency in corn and beans.

Most areas of this soil are cultivated. It has good potential for crops and pasture. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness. However, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table and by flooding. This soil also has slow permeability in the substratum and high susceptibility to frost action. Artificial drainage helps control the high water table and flooding. Houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 2.5c-c.

19—Corunna sandy loam. This nearly level, poorly drained soil is on flats and in depressions and drainageways. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to 300 acres.

Typically, the surface layer is black sandy loam about 11 inches thick. The subsoil is mottled, very friable sandy loam about 21 inches thick. The upper part is gray. The lower part is yellowish brown. The mottled substratum, to a depth of 60 inches, is grayish brown gravelly sandy loam and grayish brown and gray loam. In some areas the surface layer is less than 10 inches thick. In some places the soil is calcareous within 10 inches of the surface. In some areas there is less than 26 inches or more than 40 inches of moderately coarse textured soil over the medium textured soil.

Included with this soil in mapping are small areas of poorly drained and very poorly drained Belleville soils and somewhat poorly drained Badaxe and Shebeon soils. The Belleville soils are coarser textured than the Corunna soil and are throughout the map unit. The Badaxe and Shebeon soils are on slight knolls. In a few small areas bedrock is at a depth of less than 60 inches.

Permeability of the Corunna soil is moderate or moderately rapid in the upper part of the profile and moderately slow in the lower part. The Corunna soil has moderate available water capacity and very slow or ponded runoff. In undrained areas the water table comes to within 1 foot of the surface during the winter and spring months. The organic matter content of the surface layer is relatively high. This may cause manganese deficiency in sugar beets, beans, oats, and barley.

Most areas of this soil are cultivated or are in woodland. It has good potential for cultivated crops, pasture, and wetland wildlife. It has fair potential for woodland. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness. However, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Much of this soil is wooded, but little of it is managed for this use. Most stands have many diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted. Planting more seedlings than necessary will help compensate for high seedling mortality.

Shallow ponds can be dug to encourage wetland wildlife. Reeds, sedges, cattails, and other marsh grasses will naturally become established to provide food and cover. Deep ponds can be dug and stocked with fish.

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table and flooding. This soil also has moderately slow permeability in the substratum and is highly susceptible to frost action. Artificial drainage helps control the high water table and flooding. Houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 3/2c.

20A—Covert sand, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on low ridges, flats, and low knolls. Individual areas are linear or irregular in shape and range from 4 to several hundred acres.

Typically, the surface layer is very dark grayish brown sand about 4 inches thick. The subsurface layer is light brownish gray sand about 6 inches thick. The subsoil is about 25 inches thick. The upper part is strong brown, loose sand; the lower part is brownish yellow, mottled, loose sand. The substratum, to a depth of about 60 inches, is light yellowish brown sand. In some places, precipitated iron, aluminum, and organic matter have not accumulated in the soil. In some places the soil has a layer of clay accumulation in the subsoil. In some areas there is loamy soil in the substratum.

Included with this soil in mapping are small areas of somewhat poorly drained Pipestone soils. They are in depressions and drainageways. Also included are excessively drained Plainfield soils on knolls.

Permeability of the Covert soil is rapid. The Covert soil has low available water capacity and very slow runoff. In undrained areas the water table is within 1 1/2 to 3 1/2 feet of the surface during the winter and spring months.

Most areas of this soil are cultivated or are in woodland. Potential is fair for cultivated crops. It is good for pasture and woodland. It is poor for wildlife and recreation. It is fair for sanitary facilities and building development.

This soil is suited to small grains, corn, grasses, and legumes. Soil blowing and maintaining content of organic matter are the major concerns, although low areas and drainageways are wet in spring and may need artificial drainage.

Tree windbreaks, rye buffer strips, cover crops, and residue management will help control soil blowing. No-till planting is helpful. This soil is often droughty in the summer. Irrigation will increase production.

A good rotation, returning crop residues to the soil, and the regular addition of other organic matter will help maintain or increase organic matter. This will improve fertility and increase available water.

The use of this soil for pasture is effective in controlling erosion. During the summer, when this soil often lacks sufficient moisture, overgrazing may result in soil blowing. Proper stocking, rotational or strip grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is often in woodland but is seldom managed for this use. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will regenerate without planting. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil can support wildlife if managed carefully. Woodland wildlife habitat can be improved by planting mast trees for food and coniferous trees for cover. Planting berry-producing shrubs along fence rows will encourage openland wildlife. Digging shallow ponds in low areas will attract wetland wildlife; however, they may dry up during the summer.

Most areas of this soil can be developed for recreation if protected from soil blowing. The grass cover is usually sparse. Wood chips can be used where foot traffic is heavy. Large open areas can be protected with tree windbreaks. Trails are easy to make and maintain.

This soil can generally be used as building sites. The major limitation is the seasonal high water table. Artificial drainage helps control the high water table. Basements should be carefully designed to prevent entry of water. Because it is rapidly permeable, use of this soil for septic tank absorption fields may pollute the ground water.

This soil is in capability subclass IVs; Michigan soil management group 5a.

23—Fluvaquents, loamy. These are somewhat poorly drained and poorly drained, nearly level soils. They are on narrow stream bottoms and are ordinarily flooded by stream overflow for brief periods each year. Individual areas are linear or winding in shape and range from 10 to several hundred acres.

A typical area has a loam surface layer about 6 inches thick. The underlying material is mottled, friable loam in the upper part, and stratified sand, gravel, and partially decomposed plant remains in the lower part.

A broad level of classification is used for soils of this map unit because of the wide variation observed in the profiles examined. For example, in many places the substratum is loamy rather than sandy.

Included with these soils in mapping are small areas of somewhat poorly drained Avoca, Riverdale, and Sheboen soils on knolls that do not flood. Also included are the very poorly drained Linwood soils that have a muck surface layer. They are in old stream channels. In a few small areas throughout the unit, bedrock is at a depth of less than 60 inches.

Most areas of these soils are wooded. Potential is poor for cultivated crops and pasture. It is good for woodland. It is fair for woodland wildlife and good for wetland wildlife. It is fair to poor for recreational uses. It is poor for sanitary facilities and building site development.

Cultivated crops are seldom grown on these soils because of flooding from stream overflow and wetness. Usually it is not economically practical to overcome these problems. A few areas of these soils in favorable locations are used for cultivated crops. Flooding, wetness, and soil compaction are the major management concerns.

These soils are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause soil compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

These soils are mostly in woodland but are seldom managed for this use. Most stands have many diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted. Planting more seedlings than necessary will help compensate for high seedling mortality.

Woodland wildlife can usually find adequate food and cover. Habitat for wetland wildlife can be improved by digging shallow ponds. The use of these soils for recreational development is impractical because of the high water table and flooding.

Using these soils as building sites and for sanitary facilities is not practical. The high water table and flooding are extremely difficult to overcome.

These soils are in capability subclass Vw; Michigan soil management group L2c.

24—Aquents and Histosols, ponded. These are very poorly drained, nearly level soils. They are in marsh areas, most of which are always flooded. Individual areas are irregular in shape and range from 10 to several hundred acres. The soils classified as Aquents make up 25 to 95 percent of these areas and the soils classified as Histosols make up about 0 to 70 percent. Together, these soils make up about 95 percent of the map unit. These two soils are so similar in use and management that it is not practical to separate them in mapping.

A typical area of Aquents has a gray sand surface layer about 6 inches thick. The underlying material is gray very fine sandy loam and loam in the upper part and brown loam in the lower part.

A typical area of Histosols has a black muck surface layer about 20 inches thick. The underlying material is gray very fine sandy loam in the upper part and brown loam in the lower part.

A broad level of classification is used for soils of this map unit because of the wide variation observed in the profiles. For example, Aquents are often sandy to a depth of 60 inches. Histosols may have a marl layer.

Included with these soils in mapping are small areas of Udipsamments. They are in areas that have been built up by sandy material.

Most areas of these soils are in marsh. They have good potential for wetland wildlife (fig. 7).

These soils are in capability subclass VIIIw.

26B—Boyer loamy sand, 0 to 6 percent slopes. This nearly level and gently undulating, well drained soil is on flats, low ridges, and low knolls. Individual areas are linear or irregular in shape and range from 4 to 200 acres.

Typically, the surface layer is dark brown loamy sand about 7 inches thick. The subsoil is about 20 inches thick. The upper part is loose, strong brown sand; the middle part is dark brown, friable gravelly loam; the lower part is yellowish brown, very friable loamy sand. The substratum, to a depth of about 60 inches, is light yellowish brown, stratified sand and gravel (fig. 8). Precipitated iron, aluminum, and organic matter have accumulated in the soil in some places.

Included with this soil in mapping are small areas of moderately well drained Covert soils and soils similar to Boyer soils but moderately well drained. They are in slight depressions. Also included are somewhat poorly drained Riverdale and Pipestone soils. They are in depressions and drainageways.

Permeability of the Boyer soil is moderately rapid in the upper part of the profile and rapid in the lower part. The Boyer soil has low available water capacity and slow runoff.

Most areas of this soil are cultivated or are in woodland. It has fair potential for cultivated crops and recreational uses. It has good potential for pasture, woodland,

Figure 7.—Aquents and Histosols, ponded, provide suitable vegetation for wetland wildlife on an inland marsh in Rush Lake.

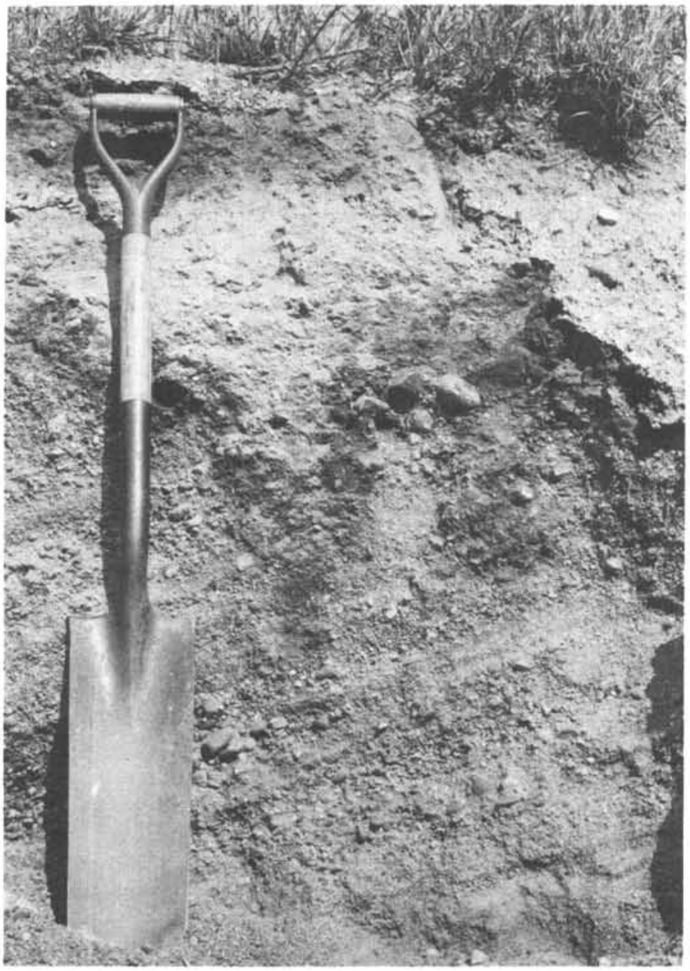


Figure 8.—Profile of Boyer loamy sand. The dark wavy band in the center is gravelly loam.

and woodland wildlife. It has good potential for sanitary facilities and building site development.

This soil is suited to small grains, corn, grasses, and legumes. Droughtiness, maintaining the level of organic matter, and soil blowing are the major concerns.

Low areas and drainageways are wet in spring and may need tile drainage. Tree windbreaks, rye buffer strips, cover crops, and crop residue management will help control soil blowing. No-till planting can also be used. This soil is often droughty in the summer. Irrigation will increase production.

A good rotation, returning crop residues to the soil, and regular addition of other organic matter help maintain or increase soil organic matter. This will improve fertility and increase water available for plants.

The use of this soil for pasture is effective in controlling erosion. During the summer, when this soil often lacks sufficient moisture, overgrazing may result in soil blowing. Proper stocking, rotational or strip grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is often wooded but is seldom managed for this use. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will regenerate without planting. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

This soil provides good habitat for woodland wildlife. Planting berry-producing shrubs along fence rows will help attract openland wildlife.

Most areas of this soil can be developed for recreation. The grass cover is usually sparse. Wood chips can be used where foot traffic is heavy. Playgrounds should be developed in the less sloping areas. If a loamy topsoil is added, a good sod cover can be established. Large open areas can be protected by tree windbreaks. Trails are easy to make and maintain.

This soil can usually be used as building sites. Because the soil is rapidly permeable in the substratum, its use for septic tank absorption fields may cause pollution of the ground water.

This soil is in capability subclass IIIs; Michigan soil management group 4a.

26C—Boyer loamy sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on ridges and knolls. Individual areas are irregular or linear in shape and range from 4 to 200 acres.

Typically, the surface layer is brown loamy sand about 6 inches thick. The subsoil is about 18 inches thick. The upper part is strong brown, very friable loamy sand; the lower part is brown, very friable gravelly sandy loam. The substratum, to a depth of about 60 inches, is light yellowish brown, stratified sand and gravel. Precipitated iron, aluminum, and organic matter have accumulated in the soil in some places.

Included with this soil in mapping are Guelph soils, which are finer textured than the Boyer soils. They are interspersed throughout the unit.

The Boyer soil has moderately rapid permeability, low available water capacity, and medium runoff.

Most areas of this soil are cultivated or are in woodland. Potential is fair for cultivated crops. It is good for pasture, woodland, and woodland wildlife. It is fair for recreational uses other than playgrounds. It is fair for sanitary facilities and building site development.

This soil is suited to small grains, corn, grasses, and legumes. Soil blowing, water erosion, and maintaining the level of organic matter are the major concerns.

Tree windbreaks, rye buffer strips, cover crops, grassed waterways, residue management, and good rotation using minimum tillage help control soil blowing. No-till planting can be used. This soil is often droughty in the summer. Irrigation will increase production.

A good rotation, returning crop residues to the soil, and regular addition of other organic matter help maintain or increase soil organic matter. This will improve fertility and increase available water.

The use of this soil for pasture is effective in controlling erosion. During the summer, when this soil often lacks sufficient moisture, overgrazing may result in soil blowing. Proper stocking, rotational or strip grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is often wooded but is seldon managed for this use. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will regenerate without planting. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

This soil provides good habitat for woodland wildlife. Planting berry-producing shrubs along fence rows will help attract openland wildlife.

Most areas of this soil can be developed for recreation other than playgrounds. Because the grass cover is usually sparse, wood chips can be used where foot traffic is heavy. Large open areas can be protected by tree windbreaks. Trails are easy to make and maintain. Some land shaping may be necessary for campsites and picnic areas.

This soil can generally be used as building sites. The major concern is slope. The slope can be overcome by land forming and by building local roads and streets on the contour. Because it is rapidly permeable, use of this soil for septic tank absorption fields may pollute the ground water.

This soil is in capability subclass IIIe; Michigan soil management group 4a.

27—Filion stony loam. This nearly level, poorly drained soil is on flats. It is subject to frequent flooding.

Individual areas are irregular in shape and range from 4 to several hundred acres.

Typically, the surface layer is very dark gray, calcareous stony loam about 5 inches thick. The subsoil is gray, mottled, firm loam about 9 inches thick. The mottled substratum, to a depth of about 60 inches, is pale olive, olive gray, and gray, very firm loam and clay loam. In some areas the surface 10 inches is not calcareous. In some places there are no bright mottled colors within 30 inches of the surface. In some areas the depth to very firm substratum is more than 24 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Badaxe and Aubarque soils on knolls and low ridges. Also included throughout the map unit are areas of Corunna soils which are coarser textured than the Filion soils and a few small areas in which bedrock is at a depth of less than 60 inches.

Permeability of the Filion soil is moderate or moderately slow in the upper part of the profile and very slow in the lower part. The Filion soil has low available water capacity and very slow or ponded runoff. In undrained areas the water table is perched within 1 foot or less of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are in woodland. Potential is poor for cultivated crops, pasture, and recreational uses. It is fair for woodland. It is good for wetland wildlife. It is poor for sanitary facilities and building site development.

Cultivated crops and pasture are seldom grown on this soil because of the many stones and cobbles and the wetness. Generally it is not economically practical to overcome these limitations.

This soil is mostly wooded but is seldom managed for this use. Most stands have many diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted. Planting more seedlings than necessary will help compensate for high seedling mortality.

Shallow ponds can be dug to encourage wetland wildlife. Reeds, sedges, cattails, and marsh grasses will naturally become established to provide food and cover. Deep ponds can be dug and stocked with fish.

This soil is impractical for recreational development because of a high water table, flooding, and stoniness.

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table and flooding. This soil also has very slow permeability in the substratum and is highly susceptible to frost action. Artificial drainage helps control the high water table and flooding. Houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass Vw; Michigan soil management group Gc-cd.

28B—Covert-Tobico complex, 0 to 6 percent slopes. This map unit consists of nearly level and gently sloping soils that are moderately well drained, poorly drained, or very poorly drained. It is about 40 to 50 percent Covert soil and 20 to 30 percent Tobico soil. The Covert soil is on ridges and is moderately well drained. The Tobico soil is in swales between the ridges, is poorly drained or very poorly drained, and is subject to frequent flooding. Areas of these soils are so intricately mixed or so small in extent that it is not practical to map them separately. Individual areas are irregular or linear in shape and range from 40 to more than 1,000 acres.

Typically, the Covert soil has a thin layer of matted leaves, twigs, and mixed sand and humus over the surface layer. The surface layer is very dark grayish brown sand about 2 inches thick. The subsurface layer is light gray sand about 4 inches thick. The subsoil is about 20 inches thick. It is loose sand that is brown in the upper part and grades to yellowish brown in the lower part. The substratum, to a depth of about 60 inches, is light yellowish brown, mottled sand. In some places, precipitated iron, aluminum, and organic matter have not accumulated in the soil.

Typically, the Tobico soil has a surface layer about 9 inches thick. The upper part is black mucky sand. The lower part is very dark gray sand. The calcareous subsoil is about 18 inches thick. It is grayish brown, mottled, loose sand. The substratum, to a depth of about 60 inches, is grayish brown, mottled fine sand. The surface layer is up to 16 inches of muck in places. In some places the soil is calcareous at a depth of more than 15 inches. In some areas there is loamy soil in the substratum.

Included with these soils in mapping are small areas of excessively drained Plainfield soils. They are on the highest elevations of the ridges. Also included are very poorly drained Adrian soils that have a muck surface layer. They occur throughout the swales. A few small areas that have bedrock at a depth of less than 60 inches occur throughout the map unit.

Covert and Tobico soils have rapid permeability and low available water capacity. Runoff is very slow from the Covert soil and is very slow or ponded on the Tobico soil. In undrained areas during the winter and spring months the water table is within 1 1/2 to 3 1/2 feet of the surface of the Covert soil and is within 1 foot or less of the surface of the Tobico soil.

Most areas of these soils are in woodland. Potential is poor for cultivated crops and recreational uses. It is good for woodland. It is good for wetland wildlife. The Covert soil on the ridges has fair potential for sanitary facilities and as building sites.

Cultivated crops are seldom grown on these soils because of the irregular topography, wetness, low fertility, and susceptibility to soil blowing. Usually it is not economically practical to overcome these problems.

These soils are often wooded, but are seldom managed for this use. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will regenerate without planting. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Shallow ponds can be dug to encourage wetland wildlife. Reeds, sedges, cattails, and other marsh grasses will naturally become established to provide food and cover. Deep ponds can be dug and stocked with fish.

These soils can be developed for recreation if managed carefully (fig. 9). They have a high water table. Drainage outlets are difficult to find. Land shaping may be necessary to develop campsites or picnic areas because the ridges and swales are narrow. Cleared areas should be small to prevent soil blowing. A good sod cover should be established on playgrounds. Watering may be necessary because these soils are droughty in the summer. Trails are easy to make and maintain.

The Covert soil can usually be used as building sites. It is best not to place buildings on the Tobico soil, which is in swales and low areas. The major limitation of both soils is the seasonal high water table. If they are used

Figure 9.—The Covert-Tobico complex provides suitable sites for picnics and other recreation.

for septic tank absorption fields, ground water may be polluted because of the rapid permeability of these soils. Artificial drainage will help control the high water table. Basements should be carefully designed and constructed to prevent entry of water.

This complex is in capability subclass Vw; Michigan soil management groups 5a and 5c.

29A—Pipestone-Tobico-Adrian complex, 0 to 2 percent slopes. This map unit consists of nearly level soils that are somewhat poorly drained, poorly drained, and very poorly drained. The Tobico and Adrian soils are subject to frequent flooding. These soils are on alternating low, narrow ridges and in wide swales. Individual areas are irregular in shape and range from 40 to several hundred acres. The Pipestone soil is somewhat poorly drained. It is on narrow ridges and makes up 20 to 40 percent of the unit. The Tobico soil is poorly drained or very poorly drained. It is in swales between ridges and makes up 20 to 40 percent of the unit. The Adrian soil is very poorly drained. It is also in swales between ridges and makes up 10 to 20 percent of the unit. Areas of the three soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the Pipestone soil has a thin layer of matted leaves, twigs, and mixed sand and humus over the surface layer. The surface layer is very dark gray sand about 4 inches thick. The subsurface layer is light brownish gray sand about 7 inches thick. The subsoil is about 23 inches thick. It is mottled, loose sand that is dark brown in the upper part and grades to brown in the lower part. The substratum, to a depth of about 60 inches, is light yellowish brown, mottled sand and fine sand. In some places precipitated iron, aluminum, and organic matter have not accumulated in the soil. In some areas there is loamy soil in the substratum.

Typically, the Tobico soil has a surface layer of black mucky sand about 6 inches thick. The subsoil is about 20 inches thick. It is grayish brown, mottled, loose sand. The substratum, to a depth of about 60 inches, is gray fine sand. The surface layer is muck up to 16 inches thick. In some areas there is loamy soil in the substratum.

Typically, the Adrian soil has a surface layer of black muck about 28 inches thick. The substratum, to a depth of about 60 inches, is olive sand. In some areas there is loamy soil in the substratum.

Included with these soils in mapping are small areas of moderately well drained Covert soils. They are on knolls and low ridges. A few small areas that have bedrock at a depth of less than 60 inches occur throughout the map unit.

Pipestone and Tobico soils have rapid permeability and low available water capacity. Permeability of the Adrian soil is moderately slow to moderately rapid in the upper part of the profile, and rapid in the lower part. These soils have very high available water capacity. Runoff is very slow from the Pipestone soils and very slow or ponded from the Tobico and Adrian soils. In undrained areas during the winter and spring months the water table is within 1/2 to 1 1/2 feet of the surface of the Pipestone soil and to within 1 foot of the surface of the Tobico and Adrian soils.

Most areas of these soils are in woodland. Potential is poor for cultivated crops and recreational uses. It is fair for woodland. It is good for wetland wildlife. It is poor for sanitary facilities and building site development.

Cultivated crops are seldom grown on these soils because of wetness, low fertility, and susceptibility to soil blowing. Usually it is not economically practical to overcome these problems.

These soils are mostly wooded, but are seldom managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. Planting more seedlings than necessary will help compensate for high seedling mortality. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Shallow ponds can be dug to encourage wetland wildlife. Reeds, sedges, cattails, and other marsh grasses will naturally become established to provide food and cover. Deep ponds can be dug and stocked with fish. These soils are impractical for recreational development because of a high water table and flooding.

The use of these soils as building sites and for sanitary facilities is severely limited by the seasonal high water table and flooding. They are moderately to highly susceptible to frost action. If they are used for septic tank absorption fields, ground water may be polluted because of the rapid permeability of these soils. Artificial drainage will help control the high water table. Houses on these soils should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of these soils with a suitablle base material.

This complex is in capability subclass Vw; Michigan soil management groups 5b, 5c, M/4c.

30—Bach silt loam. This nearly level, poorly drained or very poorly drained soil is on flats and in depressions and drainageways. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to several hundred acres.

Typically, the surface layer is very dark grayish brown, calcareous silt loam about 10 inches thick. The subsoil is about 20 inches thick. It is light brownish gray, mottled, friable very fine sandy loam. The mottled substratum, to a depth of about 60 inches, is pale brown and brown, stratified loamy very fine sand to silt loam. In some areas the surface layer is less than 10 inches thick. In some places the soil is not calcareous within 10 inches of the surface.

Included with this soil in mapping are the somewhat poorly drained Sanilac soils on knolls.

Permeability of the Bach soil is moderately slow or moderate. The Bach soil has high available water capacity and very slow or ponded runoff. In undrained areas the water table is within 1 foot of the surface during the winter and spring months. The surface layer contains free lime, which may cause manganese deficiency in sugar beets, beans, oats, and barley and zinc deficiency in corn and beans.

Most areas of this soil are cultivated. It has good potential for cultivated crops, pasture, and wetland wildlife. It has poor potential for sanitary facilities and building development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where the surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Shallow ponds can be dug to encourage wetland wildlife. Reeds, sedges, cattails, and marsh grasses will become naturally established to provide food and cover. Deep ponds can be dug and stocked with fish.

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table and by flooding. This soil has moderately slow to moderate permeability in the substratum and is highly susceptible to frost action. Artificial drainage helps control the high water table. Houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 2.5c-cs.

31—Belleville loamy sand. This nearly level, poorly drained or very poorly drained soil is on flats and in depressions and drainageways. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to 200 acres.

Typically, the surface layer is black loamy sand about 11 inches thick. The subsoil is grayish brown, mottled, very friable loamy sand about 9 inches thick. The mottled substratum, to a depth of about 60 inches, is light brownish gray sand and grayish brown and gray loam. In some areas the surface layer is less than 11 inches thick. In some places the surface 10 inches is calcareous. In some areas, this soil has a brown subsoil. In some areas there is less than 20 inches, and in other areas more than 40 inches, of sandy soil over the loamy soil.

Included with this soil in mapping are small areas of somewhat poorly drained Avoca and Pipestone soils on knolls.

Permeability of the Belleville soil is rapid in the upper part of the profile and moderately slow in the lower part. The Belleville soil has moderate available water capacity and very slow or ponded runoff. In undrained areas the water table is within 1 foot of the surface during the winter and spring months. The organic-matter content of the surface layer is relatively high. This may cause manganese deficiency in sugar beets, beans, oats, and barley.

Most areas of this soil are cultivated or are in woodland. Potential is fair for cultivated crops and good for pasture. It is poor for woodland and fair for openland, woodland, and wetland wildlife. It is poor for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil blowing are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

This soil is often droughty in summer. Irrigation will increase production. Tree windbreaks, rye buffer strips, cover crops, a good rotation, and crop residue management can help control soil blowing. No-till planting can also be used.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Much of this soil is wooded but little of it is managed for this use. Woodland productivity is low. Most stands have many diseased, crooked, and forked trees and low-value species. These should be harvested gradually and the better trees saved. Wetness and the heavy growth of unwanted plants prevent natural regeneration or artificial restocking of desirable species unless sites are intensively prepared and maintained.

Wooded areas of this soil can support wildlife if a moderate level of management is used. Woodland wildlife can usually find adequate food and cover. Berry-producing shrubs can be planted along fence rows for openland wildlife. Habitat for wetland wildlife can be improved by digging shallow ponds.

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table and by flooding. This soil also has moderately slow permeability in the substratum and is highly susceptible to frost action. Artificial drainage helps control the high water table. Houses on this soil should be built without basements.

The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of soil with a suitable base material.

This soil is in capability subclass IIIw; Michigan soil management group 4/2c.

32C—Plainfield-Covert sands, 2 to 12 percent slopes. This map unit consists of gently sloping and moderately sloping soils that are excessively drained and moderately well drained. These soils are on low ridges. Individual areas are irregular or linear in shape and range from 40 to more than 1,000 acres. The Plainfield soil is excessively drained. It is on gently sloping and moderately sloping ridges and makes up about 50 to 70 percent of the map unit. The Covert soil is moderately well drained. It is on the gently sloping ridges and often in the gently sloping areas between ridges occupied by Plainfield soils. The Covert soil makes up about 20 to 40 percent of the map unit. Areas of the two soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the Plainfield soil has a thin layer of matted leaves, twigs, and mixed sand and humus over the surface layer. The surface layer is very dark brown sand about 1 inch thick.

The subsoil is about 19 inches thick. It is loose sand that is yellowish brown in the upper part and grades to brownish yellow in the lower part. The substratum, to a depth of about 60 inches, is light yellowish brown sand. In some places, precipitated iron, aluminum, and organic matter have accumulated in the soil.

Typically, the Covert soil has a thin layer of matted leaves, twigs, and mixed sand and humus over the surface layer. The surface layer is very dark grayish brown sand about 2 inches thick. The subsurface layer is light brownish gray sand about 4 inches thick. The subsoil is loose sand about 26 inches thick. The upper part is brown. The lower part is yellowish brown. The substratum, to a depth of about 60 inches, is light yellowish brown, mottled sand and fine sand. In some places, precipitated iron, aluminum, and organic matter have not accumulated in the soil.

Included with these soils in mapping are small areas of somewhat poorly drained Pipestone soils and poorly drained Tobico soils. They are in depressions.

Permeability of the Plainfield and Covert soils is rapid. The Plainfield soil has very low available water capacity and medium runoff. The Covert soil has low available water capacity and very slow runoff. In undrained areas the water table is within 1 1/2 to 3 1/2 feet of the surface of the Covert soil during the winter and spring months.

Most areas of these soils are in woodland. Potential is poor for cultivated crops and wildlife. It is good for woodland and fair for recreational uses. It is fair for sanitary facilities and building site development.

Cultivated crops are not generally grown on these soils because of droughtiness, low fertility, and susceptibility to soil blowing and water erosion. Crops often dry up during the summer and are not harvestable.

These soils are mostly in woodland but are seldom managed for this use. Many stands are understocked. Diseased, crooked, and forked trees should be harvested and the better trees saved. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of these soils can support wildlife if managed carefully. Woodland wildlife habitat can be improved by planting mast trees for food and coniferous trees for cover. Planting berry-producing shrubs along fence rows will encourage openland wildlife. Digging shallow ponds in low areas will attract wetland wildlife. However, these may dry up during the summer.

These soils can be developed for recreational areas other than playgrounds (fig. 10). The grass cover is usually sparse. Wood chips can be used where foot traffic is heavy. Large open areas can be protected with tree windbreaks. Trails are easy to make and maintain. Some land shaping may be necessary for campsites and picnic areas.

These soils can generally be used as building sites. The major limitation is slope. It can be overcome by land forming and placing local roads and streets on the contour. Because they are rapidly permeable, use of these soils for septic tank absorption fields may pollute the ground water. It is best not to place buildings on the Covert soil because of the seasonal high water table.

These soils are in capability subclass VIs; Michigan soil management groups 5.3a, 5a.

34—Aurelius muck. This nearly level, very poorly drained soil is in bogs. This soil is subject to frequent flooding. Individual areas are irregular in shape and range from 4 to 200 acres.

Typically, the surface layer is black, calcareous muck about 8 inches thick. The substratum, to a depth of 60 inches, is light gray marl in the upper part and yellowish

Figure 10.—Recreational shoreline development of Plainfield-Covert sands.

brown sandy loam in the lower part. In some places the surface layer is more than 16 inches thick. The marl portion of the substratum is less than 16 inches thick in some profiles. In some areas the loamy soil in the substratum is shallower than 24 inches.

Included with this soil in mapping are small areas of Linwood soils which have a thicker muck surface layer than Aurelius soils and do not have a marl layer. They are throughout the unit.

Permeability of the Aurelius soil is moderately slow to moderately rapid in the upper part of the profile and moderate in the lower part. The available water capacity is high, and runoff is very slow or ponded in the lower part. In undrained areas the water is within 1/2 foot of the surface during the winter and spring months. The high pH of this soil may cause a deficiency of boron in sugar beets, of manganese in beans, oats, wheat, sugar beets, and barley, and of zinc in beans and corn.

Most areas of this soil are cultivated or are in woodland. Potential is fair for cultivated crops and good for pasture if drained. It is poor for woodland and good for wetland wildlife. It is poor for sanitary facilities and building development.

This soil is suited to the crops commonly grown in this area if drainage is possible. Wetness, frost, and soil blowing are the major concerns. The lack of suitable outlets and hazard of frost are limitations in most areas.

Surface drainage, where suitable drainage outlets are available, is needed to use this soil for pasture. Most areas remain undrained.

Commercial woodland production is generally not economically practical on this soil. Trees grown slowly because of the high water table. Many areas are too wet for trees and grow only shrubs. Trees are likely to be blown over because of the wetness and instability of this soil. Planting seedlings is difficult because this soil is usually too wet.

Shallow ponds can be dug to encourage wetland wildlife. Reeds, sedges, cattails, and marsh grasses will naturally become established to provide food and cover. Deep ponds can be dug and stocked with fish. Sides should be partly graded to prevent caving and sloughing.

Building site development is not practical on this soil. The high water table, flooding, and instability of this soil are extremely difficult to overcome.

This soil is in capability subclass Vw; Michigan soil management group M/mc.

36A—Pipestone sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flats, low knolls, and low ridges. Individual areas are irregular or linear in shape and range from 4 to several hundred acres.

Typically, the surface layer is black sand about 2 inches thick. The subsurface layer is light brownish gray sand about 8 inches thick. The subsoil is mottled loose sand about 26 inches thick. The upper part is strong brown. The lower part is brown. The substratum, to a depth of about 60 inches, is light yellowish brown and pale brown, mottled sand. In some places, precipitated iron, aluminum, and organic matter have not accumulated in the soil. In some places the soil has a layer of clay accumulation in the subsoil. In some areas there is loamy soil in the substratum at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of moderately well drained Covert soils on knolls. Also included are poorly drained and very poorly drained Granby soils in depressions and drainageways.

Permeability of the Pipestone soil is rapid. The available water capacity is low, and runoff is slow or very slow. In undrained areas the water table is within 1/2 to 1 1/2 feet of the surface during the winter and spring months.

Most areas of this soil are cultivated or are in woodland. Potential is fair for cultivated crops and good for pasture. It is fair for woodland and poor for wildlife. It is poor for sanitary facilities and building development.

This soil is suited to the cultivated crops commonly grown in this area, with the exception of sugar beets. Wetness, soil blowing, and maintaining organic matter content are the major concerns.

Combined surface and subsurface drainage helps control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

This soil is often droughty in the summer. Irrigation will increase production. Tree windbreaks, rye buffer strips, cover crops, and crop residue management can help control soil blowing. No-till planting can be used. A good rotation, returning crop residues to the soil, and the regular addition of other organic matter will help maintain or increase soil organic matter. This will improve fertility and increase available water.

Undrained areas are sometimes used for pasture. During the summer, when this soil often lacks sufficient moisture, overgrazing may result in soil blowing. Proper stocking, rotational or strip grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

Much of this soil is wooded, but little of it is managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. Planting more seedlings than necessary will help compensate for high seedling mortality. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil can support wildlife if managed carefully. Woodland wildlife habitat can be improved by planting most trees for food and coniferous trees for cover. Berry-producing shrubs planted along fence rows will encourage openland wildlife. Shallow ponds in low areas will attract wetland wildlife, but may dry up during the summer.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table. This soil also has moderate susceptibility to frost action. Because the soil is rapidly permeable, its use for septic tank absorption fields may cause pollution of ground water. Artificial drainage helps control the high water table. Houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IVw; Michigan soil management group 5b.

38A—Mitiwanga cobbly sandy loam, 0 to 3 percent slopes. This moderately deep, nearly level and gently sloping, somewhat poorly drained soil is on flats and low knolls. Individual areas are irregular in shape and range from 4 to several hundred acres.

Typically, the surface layer is dark grayish brown cobbly sandy loam about 7 inches thick. The subsurface layer is brown, mottled sandy loam about 5 inches thick. The subsoil is yellowish brown, mottled, friable loam about 11 inches thick. Sandstone bedrock is at a depth of about 23 inches. In some places, the subsoil of this soil is sandy loam. Areas of this soil in McKinley and Winsor townships are underlain by limestone bedrock. Soil reactions in these areas are mildly or moderately alkaline. In some places there is more than 40 inches of loamy soil over the bedrock.

Included with this soil in mapping are small areas of poorly drained Corunna and Kilmanagh soils. They are in depressions and drainageways.

The Mitiwanga soil has moderate permeability, low available water capacity, and slow runoff. In undrained areas the water table is perched within 1/2 to 1 1/2 feet of the surface during the winter and spring months. The rooting depth is restricted by bedrock.

Most areas of this soil are cultivated or are in woodland. It has fair potential for cultivated crops. It has good potential for pasture, woodland, and openland and woodland wildlife. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Most areas have enough cobbles and stones to make seedbed preparation and harvesting difficult. If the cobbles and stones are removed, crop yields will improve and equipment wear will decrease. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness. However, excavation of ditches and installation of drainage tile may be difficult because of bedrock. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is often wooded but is seldom managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil provide good habitat for woodland wildlife. Planting berry-producing shrubs along fence rows will attract openland wildlife.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by bedrock. The bedrock limits the effectiveness of septic tank absorption fields. Cracks in the rock may allow pollution of ground water. This soil has high susceptibility to frost action. Artificial drainage helps control the high water table. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 3/Rbc.

39A—Rapson loamy sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flats, low knolls, and low ridges. Individual areas are irregular or linear in shape and range from 4 to 300 acres.

Typically, the surface layer is black loamy sand about 4 inches thick. The subsurface layer is light brownish gray sand about 5 inches thick. The mottled subsoil is about 16 inches thick. The upper part is dark brown, very friable loamy sand; the lower part is yellowish brown, loose sand. The mottled substratum, to a depth of about 60 inches, is stratified fine sand to silty clay loam. In some places precipitated iron, aluminum, and organic matter have not accumulated in the soil. In some places the subsoil has a layer of clay accumulation. In some areas the substratum is mostly fine sand and very fine sand. In other areas the substratum is loam.

Included with this soil in mapping are small areas of somewhat poorly drained Sanilac and Shebeon soils which are finer textured than the Rapson soils. They are throughout the map unit. Also included are moderately well drained Covert soils on knolls.

Permeability of the Rapson soil is rapid in the upper part and moderate in the lower part. The Rapson soil has low available water capacity and slow or very slow runoff. In undrained areas the water table is within 1 to 2 feet of the surface during the winter and spring months.

Most areas of this soil are cultivated or are in woodland. Potential is fair for cultivated crops and good for pasture. It is fair for wildlife, woodland, and recreational uses. It is poor for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness, soil blowing, and maintaining the level of organic matter are the major concerns.

Combined surface and subsurface drainage systems help control wetness. However, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

This soil is often droughty in summer. Irrigation will increase production. Tree windbreaks, rye buffer strips, cover crops, and crop residue management can help control soil blowing. No-till planting is possible on this soil.

A good system of crop rotation, returning crop residues to the soil, and regular addition of other organic matter help maintain or increase the level of organic matter. This will improve soil fertility and increase the water available for plants.

Undrained areas are sometimes used for pasture. During the summer, when this soil often lacks sufficient moisture, overgrazing may cause soil blowing. Proper stocking, rotational or strip grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is often wooded but is seldom managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. Planting more seedlings than necessary will help compensate for high seedling mortality. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil can support wildlife with a moderate level of management. Woodland wildlife can usually find adequate food and cover. Berry-producing shrubs can be planted along fence rows for openland wildlife. Habitat for wetland wildlife can be improved by digging shallow ponds.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table. This soil also has moderate susceptibility to frost action. Artificial drainage helps control the high water table; however, houses should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material. Small included areas of moderately well drained soils make the best sites for a single house. These areas are usually on small knolls or are next to natural drainageways.

This soil is in capability subclass IIIw; Michigan soil management group 4/2b-s.

40A—Wasepi loamy sand, loamy substratum, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flats, low knolls, and low ridges. Individual areas are irregular or linear in shape and range from 4 to 200 acres.

Typically, the surface layer is very dark gray loamy sand about 9 inches thick. The subsurface layer is pale brown loamy sand about 4 inches thick. The mottled subsoil is about 13 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the lower part is yellowish brown, friable gravelly sandy loam. The substratum, to a depth of about 60 inches, is grayish brown, stratified sand and gravel and grayish brown loam. In some places the loamy part of the subsoil is less than 8 inches thick. Precipitated iron, aluminum, and organic matter have accumulated in the soil in some places. In some areas the loamy part of the substratum is shallower than 40 inches.

Included with this soil in mapping are small areas of poorly drained Corunna soils and poorly drained and very poorly drained Tobico soils. They are in depressions and drainageways. Also included are a few small areas of finer textured Shebeon soils throughout the map unit.

Permeability of the Wasepi loamy substratum soil is moderately rapid in the upper part of the profile and moderately slow in the lower part. The Wasepi soil has low available water capacity and slow runoff. In undrained areas the water table is within 1 to 2 feet of the surface during the winter and spring months.

Most areas of this soil are cultivated or are in woodland. It has fair potential for crops and woodland. It has good potential for pasture and for openland and woodland wildlife. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness, soil blowing, and maintaining organic matter are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter ditches.

This soil is often droughty in the summer. Irrigation will increase production. Tree windbreaks, rye buffer strips, cover crops, and crop residue management can help control soil blowing. No-till planting is possible on this soil.

A good system of crop rotation, returning crop residues to the soil, and regular addition of other organic matter help maintain or increase the level of organic matter. This will improve soil fertility and increase the water available for plants.

Undrained areas are sometimes used for pasture. During the summer when this soil often lacks sufficient moisture, overgrazing may result in soil blowing. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is often in woodland but is seldom managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. Planting more seedlings than necessary will help compensate for high seedling mortality. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil provide good habitat for woodland wildlife. Planting berry-producing shrubs along fence rows will attract openland wildlife.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by moderately slow permeability in the substratum. This soil also is highly susceptible to frost action. Artificial drainage helps control the high water table. Houses on this soil should be built without basements. The effects of frost action on local roads and streets can be controlled by replacing or covering the upper layer of the soil with a suitable base material.

This soil is in capability subclass IIIw; Michigan soil management group 4/2b.

42A—Tyre loamy sand, 0 to 2 percent slopes. This moderately deep, nearly level, somewhat poorly drained soil is on flats, low knolls, and low ridges. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to 100 acres.

Typically, the surface layer is black loamy sand about 2 inches thick. The subsoil is dark grayish brown, very friable, loamy sand about 3 inches thick. The substratum is light gray sand and cobbly sand, pale olive loamy sand, and weathered sandstone. Unweathered sandstone bedrock is at a depth of about 32 inches. In some places precipitated iron, aluminum, and organic matter have accumulated in the soil. In some areas there is less than 20 inches or more than 40 inches of sandy soil over the bedrock.

Included with this soil in mapping are small areas of moderately well drained Deerton Variant soils. They are on knolls and low ridges. Also included are Mitiwanga soils which are finer textured than the Tyre soils. They are throughout the map unit.

Permeability of the Tyre soil is rapid. The available water capacity is very low, and runoff is very slow. In undrained areas the water table is within 1 to 1 1/2 feet of the surface during the winter and spring months. The rooting depth is restricted by bedrock.

Most areas of this soil are in woodland. Potential is poor for cultivated crops and pasture. It is fair for woodland. It is poor for wildlife and sanitary facilities and building site development.

Cultivated crops and pasture are seldom grown on this soil because of the many cobbles in the subsoil, wetness, and low fertility. Generally it is not economically practical to try to overcome these limitations.

This soil is often in woodland but is seldom managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. Planting more seedlings than necessary will help compensate for high seedling mortality. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil can support wildlife if managed carefully. Woodland wildlife habitat can be improved by planting mast trees for food and coniferous trees for cover. Berry-producing shrubs planted along fence rows will encourage openland wildlife. Shallow ponds in low areas will attract wetland wildlife but may dry up during the summer.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by bedrock at a moderate depth. The bedrock limits the effectiveness of septic tank absorption fields. Cracks in the rock may cause pollution of ground water. This soil also has moderate susceptibility to frost action. Artificial drainage helps control the high water table; however, houses on this soil should be built without basements. The effect of frost action on local roads and streets can be overcome by replacing or covering the upper layer of this soil with a suitable base material. Small included areas of moderately well drained soils make the best sites for a single house. These areas are usually on small knolls or are next to natural drainageways.

This soil is in capability subclass Vs; Michigan soil management group 4/Rbc.

43—Tobico mucky sandy loam. This nearly level, poorly drained or very poorly drained soil is on flats and in depressions and drainageways. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to 300 acres.

Typically, the surface layer is black and very dark gray, calcareous mucky sandy loam about 8 inches thick. The subsoil is about 17 inches thick. The upper part is gray, friable sandy loam; the middle part is grayish brown, mottled, very friable loamy sand; the lower part is grayish brown, mottled, loose sand. The substratum, to a depth of about 60 inches, is brown gravelly sand and dark gray sand. In some places the soil has a brown subsoil. In some areas there is loamy soil in the substratum.

Included with this soil in mapping are small areas of somewhat poorly drained Pipestone and Riverdale soils on knolls.

Permeability of the Tobico soil is rapid. The available water capacity is low, and runoff is very slow or ponded. In undrained areas the water table is within 1 foot of the surface during the winter and spring months. The surface layer contains free lime. This may cause manganese deficiency in sugar beets, beans, oats, and barley and zinc deficiency in corn and beans.

Most areas of this soil are cultivated or are in woodland. Potential is fair for cultivated crops and good for pasture. It is poor for woodland and fair for wetland wildlife. It is poor for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil blowing are the major concerns.

Combined surface and subsurface drainage help control wetness; however, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

This soil is often droughty in summer. Irrigation will increase production. Tree windbreaks, rye buffer strips, cover crops, a good rotation, and crop residue management can help control soil blowing. No-till planting is possible on this soil.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Much of this soil is wooded but little of it is managed for this use. Woodland productivity is low. Most stands have many diseased, crooked, and forked trees and low-value species. These should be harvested gradually and the better trees saved. Wetness and the heavy growth of unwanted plants prevent natural regeneration or artificial restocking of desirable species unless sites are intensively prepared and maintained.

Habitat for wetland wildlife can be improved by digging shallow ponds. Reeds, sedges, cattails, and marsh grasses will become naturally established to provide food and cover; however, ponds may dry up during the summer. Deep ponds can be dug and stocked with fish.

The use of this soil as building sites and for sanitary facilities is severely limited by the seasonal high water table and by flooding. This soil has moderate susceptibility to frost action. Septic tank absorption fields may cause pollution of ground water because of rapid permeability of the soil. Artificial drainage helps control the high water table; however, houses should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIIw; Michigan soil management group 4c-c.

44A—Badaxe cobbly sandy loam, 0 to 3 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on flats, low knolls, and low ridges. Individual areas are irregular or linear in shape and range from 4 to 200 acres.

Typically, the surface layer is very dark grayish brown, cobbly sandy loam about 7 inches thick. The subsurface layer is pale brown loamy sand about 5 inches thick. The subsoil is dark yellowish brown, mottled, friable sandy loam about 14 inches thick. The mottled substratum, to a depth of about 60 inches, is brown, firm and very firm loam. In some places clay has not accumulated in the subsoil. The lower part of the subsoil in some places is grayish brown.

Included in mapping are small areas of somewhat poorly drained Avoca soils and poorly drained Corunna and Kilmanagh soils. The Avoca soils are coarser textured than the Badaxe soils and are throughout the unit. The Corunna and Kilmanagh soils are in depressions and drainageways. In a few small areas, bedrock is at a depth of less than 60 inches.

Permeability of the Badaxe soil is moderate in the upper part of the profile and very slow in the lower part. The Badaxe soil has moderate available water capacity and medium or slow runoff. In undrained areas the water table is perched within 1 to 2 feet of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated or are in woodland. It has fair potential for crops. It has good potential for pasture and woodland and for openland and woodland wildlife. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness. However, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Because this soil is cobbly, seedbed preparation and harvesting are difficult. If the cobbles are removed, crop yields will improve and equipment wear will decrease. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Working this soil when too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Much of this soil is wooded, but little of it is managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. If conifer plantations are established, they should be thinned to avoid crowding and poor growth.

Wooded areas of this soil provide good habitat for woodland wildlife. Planting berry-producing shrubs along fence rows will attract openland wildlife.

The use of this soil as building sites and for sanitary facilities is limited by the high water table and by very slow permeability in the substratum. This soil is highly susceptible to frost action. Artificial drainage helps control the high water table and flooding. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with suitable base material.

This soil is in capability subclass IIIw; Michigan soil management group 3/2b-d.

45—Granby loamy sand. This nearly level, poorly drained or very poorly drained soil is on flats and in depressions and drainageways. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to 300 acres.

Typically, the surface layer is black loamy sand about 11 inches thick. The subsoil is grayish brown, mottled loose sand about 20 inches thick. The substratum, to a depth of about 60 inches, is brown sand and gray fine sand. In some areas the surface layer is less than 10 inches thick. In some places the soil has a brown subsoil. In some places there is loamy soil in the substratum.

Included in mapping are small areas throughout the map unit of somewhat poorly drained Pipestone and Avoca soils. They are on knolls and low ridges.

Permeability of the Granby soil is rapid. The Granby soil has low available water capacity and very slow or ponded runoff. In undrained areas the water table is within 1 foot of the surface during the winter and spring months. The organic matter content of the surface layer is relatively high. This may cause manganese deficiency in sugar beets, beans, oats, and barley.

Most areas of this soil are cultivated or are in woodland. Potential is fair for cultivated crops and good for pasture. It is poor for woodland and fair for wildlife. It is poor for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil blowing are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

This soil is often droughty in the summer. Irrigation will increase production. Tree windbreaks, rye buffer strips, cover crops, a good rotation, and crop residue management can help control soil blowing. No-till planting can be used.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is often wooded but is seldom managed for this use. Woodland productivity is low. Most stands have many diseased, crooked, and forked trees and low-value species. These should be harvested gradually and the better trees saved. Wetness and the heavy growth of unwanted plants prevent natural regeneration or artificial restocking of desirable species unless sites are intensively prepared and maintained.

Habitat for wetland wildlife can be improved by digging shallow ponds. Reeds, sedges, cattails, and marsh grasses will become naturally established to provide food and cover. These ponds may dry up during the summer. Deep ponds can be dug and stocked with fish.

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table and by flooding. This soil is moderately susceptible to frost action. Septic tank absorption fields may cause pollution of ground water because of the rapid permeability of the soil. Although artificial drainage helps control the high water table, houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIIw; Michigan soil management group 5c.

46—Linwood muck. This nearly level, very poorly drained soil is in bogs. This soil is subject to frequent flooding. Individual areas are irregular in shape and range from 4 to several hundred acres.

Typically, the surface layer is black muck about 25 inches thick. The substratum, to a depth of about 60 inches, is gray, mottled loam. In some places the surface layer is less than 16 inches thick. Some places have a thin layer of marl below the surface layer. In some areas the substratum is sandy.

Included with this soil in mapping are small areas of Pinnebog soils which have thicker organic layers than the Linwood soils. They are throughout the unit.

Permeability of the Linwood soil is moderately slow to moderately rapid in the upper part of the profile and moderate in the lower part. The Linwood soil has very high available water capacity and very slow runoff. In undrained areas the water table is within 1 foot of the surface during the winter and spring months. The high pH of this organic soil may cause a deficiency of boron in sugar beets; of manganese in beans, oats, wheat, sugar beets, and barley; and of zinc in beans and corn.

Most areas of this soil are in woodland. It has good potential for cultivated crops and pasture if drained. Potential is poor for woodland. It is good for wetland wildlife. It is poor for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area if drainage is possible. Wetness, frost, and soil blowing are the major concerns. The lack of suitable outlets and hazard of frost are limitations in most areas.

Surface drainage, when suitable drainage outlets are available, is needed in these areas for pasture. Most areas remain undrained.

Woodland production is usually not economically practical on these soils. Trees grow slowly because of the high water table. Many areas that are too wet for trees grow only shrubs. These are susceptible to being blown over because of the wetness and instability of this soil. Planting seedlings is difficult because this soil is generally too wet.

Shallow ponds can be dug to encourage wetland wildlife. Reeds, sedges, cattails, and marsh grasses will become naturally established to provide food and cover. Deep ponds can be dug and stocked with fish. Sides should be gently graded to prevent caving and sloughing.

Building site development is not practical on this soil. The high water table, flooding, and instability of this soil are extremely difficult to overcome.

This soil is in capability subclass Vw; Michigan soil management group M/3c.

49B—Grindstone-Kilmanagh loams, 0 to 4 percent slopes. This map unit consists of nearly level and gently undulating soils that are moderately well drained and poorly drained. The Kilmanagh soil is subject to frequent flooding. These soils are on an intricate system of drainageways, divides, swales, and knolls. Individual areas are irregular in shape and range from 40 to several thousand acres. The Grindstone soil is moderately well drained. It is in drainageway divides and on knolls and makes up 45 to 65 percent of the map unit. The Kilmanagh soil is poorly drained. It is in the bottoms of drainageways and swales and makes up 20 to 30 percent of the unit. Areas of the two soils are so intricately mixed or so small that it is not practical to map them separately.

Typically, the Grindstone soil has a surface layer of very dark grayish brown loam about 9 inches thick. The subsoil is about 16 inches thick. The upper part is yellowish brown friable loam; the middle part is dark brown, mottled, firm clay loam; the lower part is yellowish brown, mottled, friable loam. The substratum, to a depth of about 60 inches, is firm and very firm brown loam. In some areas there is no very firm soil in the substratum.

Typically, the Kilmanagh soil has a surface layer of very dark gray loam about 9 inches thick. The subsoil is mottled, friable loam about 25 inches thick. The upper part is grayish brown. The lower part is dark yellowish brown. The mottled substratum, to a depth of about 60 inches, is yellowish brown firm loam and brown very firm loam. In some areas there is no very firm soil in the substratum.

Included with these soils in mapping are small areas of somewhat poorly drained Avoca and Shebeon soils. Avoca soils are coarser textured than the Grindstone and Kilmanagh soils. These soils are throughout the unit.

Permeability of the Grindstone and Kilmanagh soils is moderate in the upper part of the profile and very slow in the lower part. The Grindstone and Kilmanagh soils have moderate available water capacity. Runoff is medium from the Grindstone soil and slow to ponded from the Kilmanagh soil. In undrained areas during the winter and spring months the water table is perched within 1 1/2 to 3 feet of the surface of the Grindstone soil and within 1 foot of the surface of the Kilmanagh soil. The rooting depth is restricted by very firm material in the substratum of both soils.

Most areas of these soils are cultivated. They have good potential for cultivated crops and pasture. The Grindstone soils of this unit have fair potential for sanitary facilities and building site development.

These soils are suited to the cultivated crops commonly grown in this area. Wetness, water erosion, and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness. Generally, only low areas and drainageways need tile drainage. Some nearly level areas may need a grid system of tile drainage if cash crops are to be grown. Erosion control structures may be needed where natural drainageways enter ditches.

Cover crops, grasses, waterways, crop residue management, and a good rotation using minimum tillage help to prevent erosion. No-till planting can be used. Working these soils when they are too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage or no-till planting, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

The use of these soils for pasture is effective in controlling erosion. However, overgrazing or grazing when these soils are too wet causes surface compaction, excessive runoff, and erosion. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Most areas of these soils can be developed for recreation if managed properly. These soils have a seasonal high water table. Use may need to be restricted during the winter and spring and after heavy rains. Because of the slow permeability, sanitary facilities for campsites and picnic areas should be connected to commercial sewers, if available.

The Grindstone soil of this unit can usually be used as building sites. The major concerns for both soils are the seasonal high water table and very slow permeability in the substratum. These soils are highly susceptible to frost action. Artificial drainage helps control the high water table. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of these soils with a suitable base material. It is best not to place buildings on the Kilmanagh soils.

These soils are in capability subclass IIw; Michigan soil management groups 2.5a-d, 2.5c.

50A—Shebeon-Badaxe sandy loams, 0 to 2 percent slopes. This map unit consists of nearly level soils that are somewhat poorly drained. These soils are on flats and low knolls. Individual areas are irregular in shape and range from 4 to several thousand acres. The Shebeon soil makes up 30 to 50 percent of the unit. The Badaxe soil makes up 20 to 30 percent of the unit. Areas of the two soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the Shebeon soil has a surface layer of dark brown sandy loam about 9 inches thick. The subsoil is about 8 inches thick. It is mottled, firm clay loam that is yellowish brown in the upper part and grades to grayish brown in the lower part. The mottled substratum, to a depth of about 60 inches, is yellowish brown, firm and very firm loam. In some places clay has not accumulated in the subsoil.

Typically, the Badaxe soil has a surface layer of dark brown sandy loam about 9 inches thick. The subsoil is brown, mottled, friable sandy loam about 13 inches thick. The subsoil is brown, mottled, friable sandy loam about 13 inches thick. The substratum, to a depth of about 60 inches, is firm and very firm, yellowish brown loam. In some places clay has not accumulated in the subsoil. The lower part of the subsoil is grayish brown in some areas.

Included with these soils in mapping are small areas of somewhat poorly drained Avoca and Sanilac soils and poorly drained Kilmanagh soils. The Avoca and Sanilac soils are coarser than the Shebeon and Badaxe soils and are throughout the unit. They make up about 10 to 20 percent of the unit. The Kilmanagh soils are in depressions and drainageways. A few small areas that have bedrock at a depth of less than 60 inches occur throughout the map unit.

Permeability of the Shebeon soil is moderate or moderately slow in the upper part of the profile and very slow in the lower part. Permeability of the Badaxe soil is moderate in the upper part of the profile and very slow in the lower part. Both soils have moderate available water capacity and slow or medium runoff. In undrained areas the water table is perched within 1 to 2 feet of the surface of both soils during the winter and spring months. The rooting depth is restricted by very firm material in the substratum of both soils.

Most areas of these soils are cultivated. Potential is good for cultivated crops and pasture. It is poor for sanitary facilities and building development.

These soils are suited to cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness. However, the lack of suitable drainage outlets is a problem in some areas. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Working these soils when they are too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent seedling emergence and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when these soils are too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The use of these soils as building sites and for sanitary facilities is limited by the seasonal high water table and by very slow permeability in the substratum. These soils are highly susceptible to frost action. Artificial drainage helps control the high water table and flooding. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of these soils with a suitable base material.

These soils are in capability subclass IIw; Michigan soil management groups 2.5b-d, 3/2b-d.

51B—Guelph-Londo loams, 2 to 6 percent slopes. This map unit consists of gently undulating soils that are well drained to somewhat poorly drained. These soils are in an intricate system of drainageways, divides, swales, and knolls. Individual areas are irregular in shape and range from 4 to several thousand acres. The Guelph soil is well drained and moderately well drained. It is in drainageway divides and on knolls and makes up 40 to 60 percent of the unit. The Londo soil is somewhat poorly drained. It is in drainageway bottoms and swales and nearly level areas and makes up 25 to 40 percent of the unit. Areas of the two soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the surface layer of the Guelph soil is dark brown loam about 9 inches thick. The subsoil is about 12 inches thick. The upper part is dark brown, friable clay loam. The lower part is dark yellowish brown, firm clay loam. The substratum, to a depth of about 60 inches, is dark brown and brown loam. In some areas the soil has grayish brown mottles in the subsoil. In some areas the subsoil is thicker and depth to carbonates is more than 25 inches.

Typically, the surface layer of the Londo soil is very dark grayish brown loam about 9 inches thick. The mottled subsoil is about 11 inches thick. The upper part is yellowish brown, friable loam. The lower part is brown, firm clay loam. The substratum, to a depth of about 60 inches, is brown, mottled loam.

Included with these soils in mapping are small areas of poorly drained and very poorly drained Parkhill soils. They are in the most prominent depressions and drainageways.

Permeability of the Guelph soils is moderate. The Guelph soils have high available water capacity and medium runoff. Permeability of the Londo soils is moderate or moderately slow. The Londo soils have moderate available water capacity and medium runoff. In the lower undrained areas during the winter and spring months the water table is within 2 1/2 feet of the surface of the Guelph soil and within 1 to 2 feet of the surface of the Londo soil.

Most areas of these soils are cultivated. They have good potential for cultivated crops, pasture, and woodland. They have good potential for openland and woodland wildlife and recreational uses. They have good to fair potential for sanitary facilities and building site development.

These soils are suited to the cultivated crops commonly grown in this area. Water erosion, wetness, and soil compaction are the major concerns.

Cover crops, grassed waterways, and a good rotation using minimum tillage or no-till planting help to prevent erosion. Erosion control structures may be needed where natural drainageways enter ditches.

Combined surface and subsurface drainage systems will help control wetness. Generally, only low areas and drainageways need tile drainage, but some areas that have only 2 or 3 percent slopes may need a grid system of tiles if cash crops are to be grown.

Working these soils when they are too wet results in clodding and compacting. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage or no-till planting, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

The use of these soils for pasture is effective in controlling erosion. However, overgrazing will cause surface compaction, excessive runoff, and erosion. Proper stocking and rotational or strip grazing help to keep the pasture and soil in good condition.

These soils are sometimes used for small farm woodlots. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will usually regenerate without planting. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Planting berry-producing shrubs along fence rows will attract openland wildlife. Wooded areas of these soils provide good habitat for woodland wildlife.

Most areas of these soils can be developed for recreation. Playgrounds should be developed in the less sloping areas and protected with a sod cover. Paths and trails are easy to make and maintain. Drainageways and depressions should be avoided for campsites and picnic areas.

These soils can generally be used as building sites. The major limitations are the seasonal high water table and moderate permeability. The Guelph soil is moderately susceptible to frost action and the Londo soil is highly susceptible. Artificial drainage helps control the high water table. Most soils on knolls and in other areas that have good surface drainage do not have a seasonal high water table. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of these soils with a suitable base material. It is best not to place buildings on the Londo soils.

These soils are in capability subclass IIe; Michigan soil management groups 2.5a, 2.5b.

51C—Guelph loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls and in areas adjacent to drainageways. Individual areas are irregular in shape and range from 4 to several hundred acres.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsoil is about 12 inches thick. The upper part is dark brown, firm clay loam; the lower part is dark yellowish brown, friable loam. The substratum, to a depth of about 60 inches, is brown loam. In areas where this soil has been eroded, the upper part of the subsoil has been mixed with the remaining surface layer by plowing. In these areas the surface layer is dark yellowish brown or brown clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Londo soils. They are in depressions and drainageways.

Permeability of the Guelph soil is moderate. The Guelph soil has high available water capacity and rapid runoff.

Most areas of this soil are cultivated. It has fair potential for cultivated crops. Potential is good for pasture, woodland, and openland and woodland wildlife. It is fair for recreational uses, sanitary facilities, and building development.

This soil is suited to small grains, corn, grasses, and legumes. Water erosion is the major concern. Depressions and drainageways are wet in the spring and may need artificial drainage. Cover crops, grassed waterways, crop residue management, and a good rotation using minimum tillage or no-till planting help to prevent erosion.

The use of this soil for pasture is effective in controlling erosion. However, overgrazing will cause surface compaction, excessive runoff, and erosion. Proper stocking and rotational or strip grazing help to keep the pasture and soil in good condition.

This soil is sometimes used for small farm woodlots. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will usually regenerate without planting. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas of this soil provide good habitat for woodland wildlife. Planting berry-producing shrubs along fence rows will attract openland wildlife.

Most areas of this soil can be developed for recreation other than playgrounds if protected from water erosion. A good sod cover should be established where foot traffic is heavy. Some land shaping may be necessary for campsites and picnic areas.

This soil can generally be used as building sites. The major limitations are slope and moderate permeability. This soil also is moderately susceptible to frost action. Land forming and placing local roads and streets on the contour can help correct slope problems. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layers of soil with a suitable base material.

This soil is in capability subclass IIIe; Michigan soil management group 2.5a.

51D—Guelph loam, 12 to 18 percent slopes. This rolling, well drained soil is on knolls and in areas adjacent to drainageways. Individual areas are irregular in shape and range from 4 to 100 acres.

Typically, the surface layer is brown loam about 7 inches thick. The subsoil is dark brown, firm clay loam about 9 inches thick. The substratum, to a depth of about 60 inches, is brown loam. In areas where this soil has been eroded, the upper part of the subsoil has been mixed with the remaining surface layer by plowing. In these areas the surface layer is dark yellowish brown or brown clay loam.

Included with this soil in mapping are small areas where slopes are 18 to 25 percent.

Permeability of the Guelph soil is moderate. The Guelph soil has high available water capacity and rapid runoff.

Most areas of this soil are cultivated. Potential is fair for cultivated crops. It is good for pasture, woodland, and woodland wildlife. It is poor for sanitary facilities and building site development.

This soil is suited to small grains, corn, grasses, and legumes. Water erosion is the major concern. Depressions and drainageways are wet in spring and may need artificial drainage. Cover crops, grassed waterways, a good rotation using minimum tillage, and no-till planting help to prevent erosion.

The use of this soil for pasture is effective in controlling erosion. However, overgrazing will cause surface compaction, excessive runoff, and erosion. Proper stocking and rotational or strip grazing help to keep the pasture and soil in good condition.

This soil is sometimes used for small farm woodlots. Diseased, crooked, and forked trees and low-value species should be harvested and the better trees saved. The native hardwoods will generally regenerate without planting. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

This soil provides good habitat for woodland wildlife. Planting berry-producing shrubs along fence rows will help attract openland wildlife.

This soil can generally be used as building sites. The major limitations are slope and moderate permeability. This soil is also moderately susceptible to frost action. Land forming and placing local roads and streets on the contour can help correct slope problems. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layers of this soil with a suitable base material.

This soil is in capability subclass IVe; Michigan soil management group 2.5a.

53B—Shebeon cobbly loam, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on flats and low knolls and in drainageways. Individual areas are irregular or linear in shape and range from 4 to several hundred acres.

Typically, the surface layer is very dark grayish brown cobbly loam about 9 inches thick. The mottled subsoil is about 19 inches thick. The upper part is brown, firm clay loam. The lower part is yellowish brown, friable loam. The mottled substratum, to a depth of about 60 inches, is yellowish brown, firm and very firm loam. In some places clay has not accumulated in the subsoil. In some areas the depth to very firm soil is more than 40 inches.

Included with this soil in mapping are small areas of poorly drained Kilmanagh and Corunna soils and moderately well drained Grindstone soils. The Kilmanagh and Corunna soils are in depressions and drainageways and the Grindstone soils are on knolls. A few small areas in which bedrock is at a depth of less than 60 inches are throughout the map unit.

Permeability of the Shebeon soil is moderate or moderately slow in the upper part of the profile and very slow in the lower part. The Shebeon soil has moderate available water capacity and medium or slow runoff. In undrained areas the water table is perched within 1 to 2 feet of the surface during the winter and spring months.

The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated. It has good potential for cultivated crops and pasture. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Because it is cobbly, seedbed preparation and harvesting are difficult. If the cobbles are removed, crop yields improve and equipment wear decreases. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by very slow permeability in the substratum. This soil is also highly susceptible to frost action. Artificial drainage helps control the high water table and flooding. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of soil with a suitable base material. Small included areas of moderately well drained soils make the best sites for a single house. These areas are usually small knolls or are next to natural drainageways.

This soil is in capability subclass IIw; Michigan soil management group 2.5b-d.

54B—Grindstone cobbly loam, 0 to 4 percent slopes. This nearly level and gently undulating, moderately well drained soil is on flats, on low knolls, and in areas adjacent to drainageways and low ridges. Individual areas are irregular in shape and range from 4 to 300 acres.

Typically, the surface layer is dark grayish brown cobbly loam about 7 inches thick. The subsoil is about 16 inches thick. The upper part is dark yellowish brown, friable loam; the lower part is dark brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is firm and very firm brown loam. In some areas the depth to very firm soil is more than 40 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Shebeon and Badaxe soils. They are in depressions and drainageways. A few small areas in which bedrock is at a depth of less than 60 inches are throughout the unit.

Permeability of the Grindstone soil is moderate in the upper part of the profile and very slow in the lower part. The Grindstone soil has moderate available water capacity and medium or slow runoff. In undrained areas the water table is perched within 1 1/2 to 3 feet of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated. It has good potential for cultivated crops and pasture. It has fair to poor potential for recreational uses. It has fair potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. This soil is cobbly, which makes seedbed preparation and harvesting difficult. If the cobbles are removed, crop yields will improve and equipment wear will decrease. Wetness, water erosion, and soil compaction are also major concerns.

Combined surface and subsurface drainage systems help control wetness. Generally, only low areas and drainageways need tile drainage, but some nearly level areas may need a grid system of tiles if cash crops are to be grown.

Cover crops, grassed waterways, crop residue management, and a good rotation using minimum tillage or no-till planting help to prevent erosion. Erosion control structures may be needed where natural drainageways enter ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage or no-till planting, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will maintain soil tilth.

The use of this soil for pasture is effective in controlling erosion. However, overgrazing will cause surface compaction, excessive runoff, and erosion. Proper stocking, rotational or strip grazing, and restricted use help to keep the pasture and soil in good condition.

Most areas of this soil can be developed for recreation if managed properly. Because this soil has a seasonal high water table, use may need to be restricted during the winter and spring months and after heavy rains.

This soil can generally be used as building sites. The major limitations are the seasonal high water table and very slow permeability in the substratum. This soil is also highly susceptible to frost action. Artificial drainage helps control the high water table. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIs; Michigan soil management group 2.5a-d.

55—Kilmanagh cobbly loam. This nearly level, poorly drained soil is on flats and in depressions and drainageways. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to several hundred acres.

Typically, the surface layer is very dark grayish brown cobbly loam about 9 inches thick. The subsoil is mottled, friable loam about 25 inches thick. The upper part is grayish brown; the lower part is brown. The mottled substratum, to a depth of about 60 inches, is yellowish brown, friable loam and brown, very firm loam. In some areas the depth to very firm soil is more than 50 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Shebeon and Badaxe soils on slight knolls. A few small areas in which bedrock is at a depth of less than 60 inches are throughout the map unit.

Permeability of the Kilmanagh soil is moderate in the upper part of the profile and very slow in the lower part. The Kilmanagh soil has moderate available water capacity and slow to ponded runoff. In undrained areas the water table is perched within 1 foot of the surface during the winter and spring months. The rooting depth is restricted by very firm material in the substratum.

Most areas of this soil are cultivated. It has good potential for cultivated crops and pasture. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. This soil is cobbly, which makes seedbed preparation and harvesting difficult. If the cobbles are removed, crop yields will improve and equipment wear will decrease. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where the surface ditches and natural drainageways enter larger ditches.

Working this soil when too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table and by flooding. This soil also has very slow permeability in the substratum and is highly susceptible to frost action. Artificial drainage helps control the high water table. Houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 2.5c.

56A—Riverdale-Pipestone complex, 0 to 2 percent slopes. This map unit consists of nearly level soils that are somewhat poorly drained. These soils are on flats, low ridges, and low knolls. Individual areas are irregular or linear in shape and range from 4 to several hundred acres. The Riverdale soil makes up 40 to 60 percent of the unit. The Pipestone soil makes up 20 to 35 percent of the unit. Areas of the two soils are so intricately mixed or so small that it is not practical to separate them in mapping.

Typically, the Riverdale soil has a surface layer of dark brown loamy sand about 9 inches thick. The very friable, mottled subsoil is about 16 inches thick. The upper part is yellowish brown loamy sand; the lower part is dark yellowish brown gravelly sandy loam. The substratum, to a depth of about 60 inches, is brown stratified sand and gravel. In some places clay has not accumulated in the subsoil. In some places, the soil has a layer of clay accumulation within 20 inches of the surface. The lower part of the subsoil in some places is grayish brown. In some areas there is loamy soil in the substratum.

Typically, the Pipestone soil has a surface layer of very dark grayish brown sand about 9 inches thick. The mottled subsoil is about 22 inches thick. The upper part is dark brown, very friable loamy sand; the lower part is brown, loose sand. The substratum, to a depth of about 60 inches, is light yellowish brown, mottled sand. In some places, precipitated iron, aluminum, and organic matter have not accumulated in the profile. In other places, a layer of clay accumulation is in the subsoil. In some areas there is loamy soil in the substratum.

Included with these soils in mapping are small areas of Londo soils which are finer textured than the Riverdale and Pipestone soils and small areas of Rapson soils that are finer textured in the substratum. They occur throughout the unit. Also included are poorly drained and very poorly drained Tobico soils. They are in depressions and drainageways.

Permeability of the Riverdale soil is moderately rapid. Permeability of the Pipestone soil is rapid. Both soils have low available water capacity and slow runoff. In undrained areas during the winter and spring months the water table is within 1 to 2 feet of the surface of the Riverdale soil and within 1/2 to 1 1/2 feet of the surface of the Pipestone soil.

Most areas of these soils are cultivated or are in woodland. Potential is fair for cultivated crops and woodland. It is good for pasture and openland and woodland wildlife. It is poor for sanitary facilities and building site development.

These soils are suited to the cultivated crops commonly grown in this area, with the exception of sugar beets. Wetness, soil blowing, and maintaining the level of organic matter are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

These soils are often droughty in summer. Irrigation will increase production. Tree windbreaks, rye buffer strips, cover crops, and crop residue management can help control soil blowing. No-till planting is possible on this soil.

A good system of crop rotation, returning crop residues to the soil, and regular addition of other organic matter help maintain or increase the level of organic matter. This will improve soil fertility and increase the water available for plants.

Undrained areas are sometimes used for pasture. During the summer, when these soils often lack sufficient moisture, overgrazing may result in soil blowing. Proper stocking, rotational or strip grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

These soils are often wooded but are seldom managed for this use. Most stands are dominated by low-value species and diseased, crooked, and forked trees. These should be harvested gradually and the better trees saved. Open areas should be planted to conifers. Planting more seedlings than necessary helps compensate for high seedling mortality. If conifer plantations are established, they should be thinned to prevent crowding and poor growth.

Wooded areas can support wildlife with a moderate level of management. Woodland wildlife can usually find adequate food and cover. Berry-producing shrubs can be planted along fence rows for openland wildlife.

The use of these soils as building sites and for sanitary facilities is limited by the seasonal high water table. These soils are moderately susceptible to frost action. If they are used for septic tank absoprtion fields, ground water may be polluted because of the moderately rapid and rapid permeability of these soils. Artificial drainage helps control the high water table. Houses on these soils should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of these soils with a suitable base material.

These soils are in capability subclass IIIw; Michigan soil management groups 4b, 5b.

57A—Londo loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flats and low knolls and in drainageways. Individual areas are irregular or linear in shape and range from 4 to several hundred acres.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The mottled subsoil is about 11 inches thick. The upper part is yellowish brown, friable loam; the lower part is brown, firm clay loam. The substratum, to a depth of 60 inches, is brown, mottled loam. In some places, the soil does not have grayish brown coatings in the subsoil. In some areas there is very firm soil in the substratum.

Included with this soil in mapping are small areas of well drained and moderately well drained Guelph soils on knolls. Also included are poorly drained Parkhill and Corunna soils in depressions and drainageways.

Permeability of the Londo soil is moderate or moderately slow. The Londo soil has moderate available water capacity and medium or slow runoff. In undrained areas the water table is within 1 to 2 feet of the surface during the winter and spring months.

Most areas of this soil are cultivated. It has good potential for cultivated crops and pasture. It has fair to poor potential for recreational uses and fair potential for sanitary facilities and building site development.

This soil is suited to cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where the surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The use of this soil as building sites and for sanitary facilities is limited by the seasonal high water table and by moderate or moderately slow permeability in the substratum. This soil also is highly susceptible to frost action. Artificial drainage helps control the high water table and flooding. Basements should be carefully designed to prevent entry of water. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 2.5b.

58—Parkhill loam. This nearly level, poorly drained soil is on flats and in depressions and drainageways. This soil is subject to frequent flooding. Individual areas are irregular or linear in shape and range from 4 to 200 acres.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is grayish brown, mottled, friable loam about 23 inches thick. The substratum, to a depth of about 60 inches, is grayish brown, mottled loam. In some areas there is very firm soil in the substratum.

Included with this soil in mapping are small areas of Corunna and Belleville soils which are coarser textured than the Parkhill soils. They are throughout the soil. Also included are somewhat poorly drained Londo soils on knolls.

The Parkhill soil has moderately slow permeability, high available water capacity, and very slow or ponded runoff. In undrained areas the water table is within 1 foot or less of the surface during the winter and spring months.

Most areas of this soil are cultivated. It has good potential for cultivated crops, pasture, and wetland wildlife. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil compaction are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where the surface ditches and natural drainageways enter larger ditches.

Working this soil when it is too wet results in clodding and compaction. Additional tillage to break up the surface clods further compacts the lower part of the surface layer and the subsoil. Compaction inhibits root development and reduces crop yields. Surface crusting becomes more severe when the natural structure of this soil is destroyed by compaction and by depletion of organic matter. Surface crusting may prevent the emergence of seedlings and increase runoff and erosion. Minimum tillage, cover crops, returning crop residues to the soil, and the regular addition of other organic matter will also help maintain soil tilth.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will cause surface compaction and destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

Shallow ponds can be dug to encourage wetland wildlife. Reeds, sedges, cattails, and marsh grasses will become naturally established to provide food and cover. Deep ponds can be dug and stocked with fish (fig. 11).

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table and by flooding. This soil also has moderately slow permeability in the substratum and is highly susceptible to frost action. Artificial drainage helps control the high water table. Houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIw; Michigan soil management group 2.5c.

60—Pinnebog muck. This nearly level, very poorly drained soil is in bogs. This soil is subject to frequent flooding. Individual areas are irregular in shape and range from 4 to several hundred acres.

Typically, the surface layer is black muck about 34 inches thick. The substratum, to a depth of about 60 inches, is dark reddish brown mucky peat and muck. In some places the muck and mucky peat are underlain by mineral material at depths of less than 51 inches. In some places, the soil lacks mucky peat in the substratum.

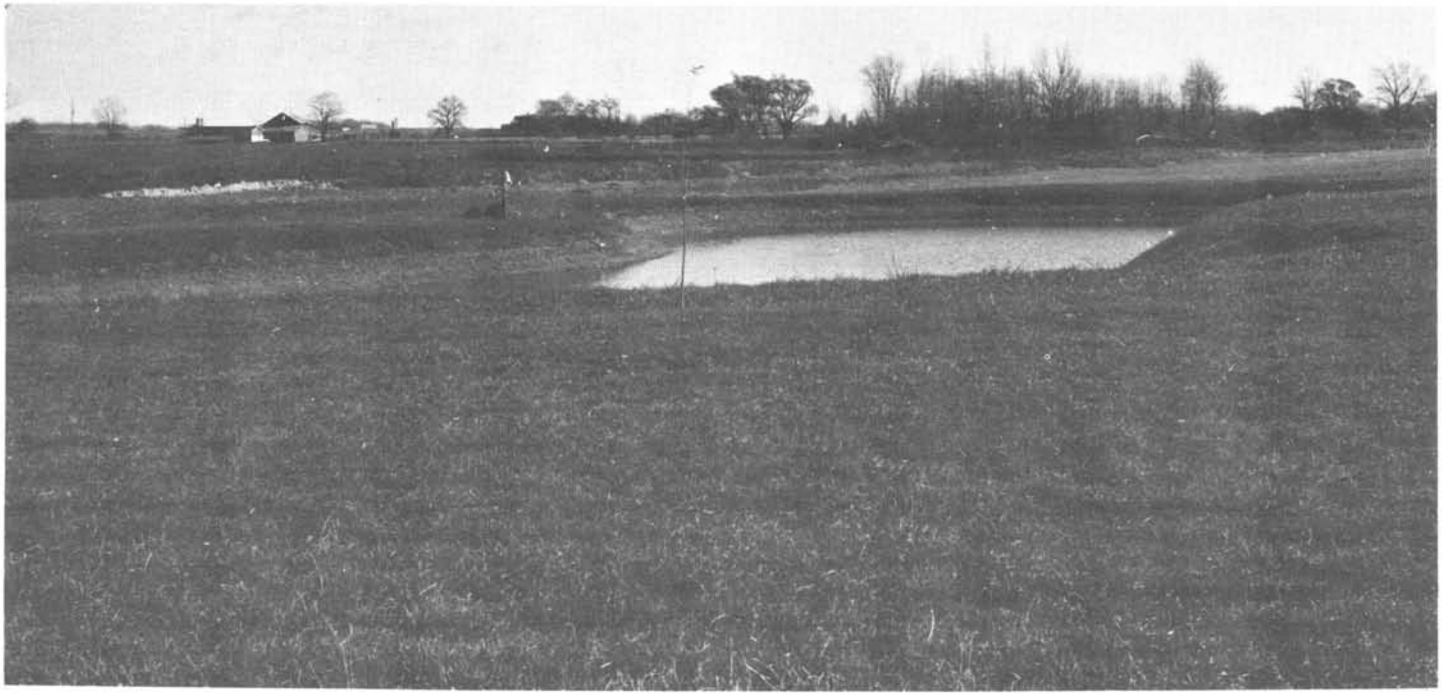


Figure 11.—A pond dug on Parkhill loam.

Included with this soil in mapping are small areas of Linwood soils which have thinner organic layers than the Pinnebog soils. They are throughout the unit.

The Pinnebog soil has moderate or moderately rapid permeability, very high available water capacity, and very slow or ponded runoff. In undrained areas the water table is within 1 foot of the surface during the winter and spring months. The high pH of this organic soil may cause a deficiency of boron in sugar beets; of manganese in beans, oats, wheat, sugar beets, and barley; and of zinc in beans and corn.

Most areas of this soil are in woodland. Potential is fair for cultivated crops and pasture. It is poor for woodland. It is good for wetland wildlife. It is poor for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area if drainage is possible. Wetness, frost, and soil blowing are the major concerns. The lack of suitable outlets and hazard of frost are limitations in most areas.

Surface drainage is needed for pasture. Most areas remain undrained for lack of outlets.

Woodland production is generally not economically practical on these soils. Trees grow slowly because of the high water table. Many areas are too wet for trees and grow only shrubs. Trees are susceptible to being blown over because of the wetness and instability of this soil. Planting seedlings is difficult because this soil is generally too wet.

Shallow ponds can be dug to encourage wetland wildlife. Reeds, sedges, cattails, and marsh grasses will become naturally established to provide food and cover. Deep ponds can be dug and stocked with fish. Sides need to be gently graded to prevent caving and sloughing.

The use of this soil for building sites is not practical. The high water table and instability of this soil are extremely difficult to overcome.

This soil is in capability subclass Vw; Michigan soil management group Mc.

62—Essexville loamy sand. This nearly level, poorly drained or very poorly drained soil is on flats. It is subject to frequent flooding. Individual areas are irregular in shape and range from 4 to 300 acres.

Typically, the surface layer is black, calcareous loamy sand about 12 inches thick. The mottled substratum is light brownish gray, loose sand and grayish brown loam. In some places the surface 10 inches is not calcareous. Some places have a brown substratum. In some areas there is less than 18 inches, and in some other areas more than 40 inches, of sandy soil over loamy soil.

Included with this soil in mapping are small areas of Tappan soils which are finer textured than Essexville soils. They are throughout the unit. Also included are somewhat poorly drained Avoca soils on slight knolls.

Permeability of the Essexville soil is rapid in the upper part of the profile and moderately slow in the lower part. The Essexville soil has moderate available water capacity and very slow or ponded runoff. In undrained areas the water table is within 1 foot of the surface during the winter and spring months. The surface layer contains free lime, which may cause manganese deficiency in sugar beets, beans, oats, and barley. It may also cause zinc deficiency in corn and beans.

Most areas of this soil are cultivated. It has fair potential for cultivated crops and good potential for pasture. It has poor potential for sanitary facilities and building site development.

This soil is suited to the cultivated crops commonly grown in this area. Wetness and soil blowing are the major concerns.

Combined surface and subsurface drainage systems help control wetness; however, some areas lack suitable outlets. Shallow surface ditches a few feet wide and a foot or less deep are effective in removing surface water from low areas after heavy rains. Erosion control structures may be needed where these surface ditches and natural drainageways enter larger ditches.

This soil is often droughty in summer. Irrigation will increase production. Tree windbreaks, rye buffer strips, cover crops, a good system of crop rotation, crop residue management, and no-till planting can help control soil blowing.

Undrained areas are sometimes used for pasture. Overgrazing or grazing when the soil is too wet will destroy the forage plants. Proper stocking, rotational or strip grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The use of this soil as building sites and for sanitary facilities is severely limited by the high water table and by flooding. This soil also has moderately slow permeability in the substratum and is highly susceptible to frost action. Artificial drainage helps control the high water table. Houses on this soil should be built without basements. The effect of frost action on local roads and streets can be controlled by replacing or covering the upper layer of this soil with a suitable base material.

This soil is in capability subclass IIIw; Michigan soil management group 4/2c-c.

63—Pits. These are miscellaneous areas from which the soil materials have been removed, leaving a pit, or depressed area, enclosed by walls of variable steepness. Rock or unconsolidated material of any texture has been removed for use elsewhere as fill or aggregate. The pit bottoms may be dry or seasonally flooded, but are not flooded year round. Individual areas of this unit range from 4 to several hundred acres.

Most of these areas remain idle. An individual assessment of each is necessary to determine its potential for different uses.

This map unit is in capability subclass VIIIs.

64—Udipsamments, nearly level. These are areas from which the original soil material has been removed or in which the original soil has been covered with fill. This usually results in a nearly level area. The soils are excessively drained to somewhat poorly drained. Most of these areas are the result of the removal of sandy ridges or knolls for use elsewhere as fill or sand, or the filling of depressions and flat swampy areas prior to building. Individual areas range from 4 to several hundred acres.

A typical area has pale brown sand in the upper part and brown, mottled sand in the lower part.

A broad level of classification is used for the soils of this map unit because of the wide variation observed in the profiles of the soils examined. For example, in many places there is loamy material at a depth of 40 to 60 inches. Depth to mottling may range from 12 inches to more than 60 inches.

Most areas of these soils remain idle or are used as building sites. An individual assessment of each area is needed to determine the potential for different uses.

This map unit is in capability subclass VIs.

Use and management of the soils

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

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

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

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

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

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

Crops and pasture

Dwight L. Quisenberry, agronomist, Soil Conservation Service, assisted in preparing this section.

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

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

More than 411,000 acres in the survey area were used for crops and pasture in 1976, according to the Agricultural Stabilization and Conservation Service and the Conservation Needs Inventory. Of this total, about 114,000 acres were used for corn, 15,000 acres for sugar beets, 85,000 acres for dry beans, 86,000 acres for small grain, mainly wheat and oats, and the rest was mainly hay and pasture.

Field crops commonly grown in the county are corn, dry beans, sugar beets, soybeans, and, to a limited extent, potatoes. Wheat and oats are the common small grains. Smaller acreages of barley and rye are grown. Grass seed can be produced from bromegrass, fescue, and redtop if economic conditions are favorable.

Special crops grown commercially in the county are very limited. There are small acreages of strawberries and cucumbers and a small number of tree farms and nurseries.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Huron County is one of the top crop producing counties in Michigan. More than 89 percent of the total area is in farms, and much of this farmland has a capability classification of II, which means that it has only moderate limitations. Food production could be increased by applying soil and water conservation practices and extending the latest crop production technology to all cropland in the county. This soil survey can suggest appropriate practices and technology.

Many concepts in agriculture are changing. Farm size has increased, and farm operations are becoming highly mechanized and scientific. In spite of changes in farm operation, however, farmers still face the same soil related problems. The following describes some of these soil management concerns.

Soil blowing is a hazard on the sandy Avoca, Covert, Rapson, Pipestone, Belleville, Plainfield, Granby, Riverdale, and Wasepi soils and on the muck of the Aurelius, Linwood, and Pinnebog soils. Crop damage can be severe in a few hours if winds are too strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, planting rye buffer strips, or using surface mulch minimizes soil blowing on these soils. Windbreaks of adapted shrubs such as Tatarian honeysuckle or redosier dogwood are effective in reducing erosion on the muck soils.

Information on erosion control for each kind of soil is available in local offices of the Soil Conservation Service.

Soil drainage is the major management need on much of the acreage used for crops and pasture in the survey area. Some soils are naturally so wet that the production of crops common to the area is not possible unless they are drained. These are the poorly drained or very poorly drained Bach, Belleville, Granby, Parkhill, and Tobico soils; the poorly drained Filion, Corunna, Kilmanagh, and Tappan soils; and very poorly drained organic Aurelius, Linwood, and Pinnebog soils.

Unless artificially drained, the somewhat poorly drained soils are so wet that crops are damaged during most years. In this category are the Aubarque, Avoca, Badaxe, Rapson, Londo, Pipestone, Riverdale, Wasepi, Sanilac, and Shebeon soils.

Guelph and Boyer soils have good natural drainage most of the year. Artificial drainage is needed in some areas of wetter soils along drainageways and swales that are commonly included in areas of the moderately well drained Covert, Deerton Variant, Gagetown, and Grindstone soils. Because these soils have a seasonal high water table, they may be slow to dry out for spring planting.

The design of both surface and subsurface drainage systems varies with the drainage of the soil. A combination of surface drainage and tile drainage is needed for most areas of the somewhat poorly drained, poorly drained, and very poorly drained soils if they are used for intensive row cropping. Random tile drainage is usually adequate for the moderately well drained soils. Finding adequate outlets for tile drainage systems is difficult in many areas of Filion, Bach, Belleville, Corunna, Kilmanagh, Parkhill, and Tobico soils.

Soil erosion is a major problem on some of the cropland in Huron County. If the slope is more than 2 percent, erosion is a major hazard. Guelph soils, for example, have slopes of 2 to 18 percent. Grindstone, Aubarque, Deerton Variant, Gagetown, and Pipestone soils have some slopes of more than 2 percent that have an additional problem of wetness.

Loss of the surface layer by erosion is damaging for two reasons—it reduces soil productivity and causes sedimentation of streams. Productivity is reduced because part of the subsoil is incorporated into the plow layer. The dominantly clay loam subsoil in the Guelph soils is less friable and contains less available moisture than the surface layer. Loss of the surface layer also limits the depth of the root zone on bedrock-controlled soils like Deerton Variant. Erosion reduces productivity on soils that tend to be droughty, such as the Boyer soils. Soil erosion can result in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control provides a protective surface cover, reduces runoff, and increases infiltration. A cropping system that keeps a vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, where hay and pasture are needed, the legume and grass forage crops in the cropping system reduce erosion on sloping land and also provide nitrogen and improve tilth for the following crop.

Slopes are so short and irregular that contour tillage is not practiced in most areas of the sloping Guelph and Boyer soils. These soils need minimum tillage or a cropping system that provides substantial vegetative cover to control erosion. Minimizing tillage and leaving crop residues on the surface help to increase infiltration and reduce the hazards of runoff and erosion. No-tillage for corn is effective in reducing erosion on the gently sloping or sloping soils. It is more difficult to practice successfully, however, where the clay loam subsoil has been mixed with the surface layer.

The use of grass or sod waterways is popular for erosion control in the survey area. Permanent vegetative cover is maintained in areas where natural surface water runoff concentrates.

Soil fertility is naturally low in the sandy soils and medium in most of the loamy soils. It is high in the poorly drained loamy Kilmanagh and Parkhill soils. Most of the soils in the survey area are neutral or mildly alkaline. The Bach, Sanilac, Tappan, Gagetown, and Aubarque soils are calcareous or are calcareous within 10 inches of the surface. The high pH level of these soils causes deficiencies of manganese, boron, and zinc in certain row crops. The Covert, Deerton Variant, and Pipestone soils are medium acid. They may require applications of lime to raise the pH level sufficiently for good growth of alfalfa and other crops that grow best on nearly neutral soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kind and amount of fertilizer and lime to apply (*4*).

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Many of the soils used for crops in the survey area have a loamy surface layer. Generally the structure of such soils is weak. Heavy machinery will compress and crush aggregates of a soil that is too wet to work. Plowing, tilling, cultivating or other operations of machinery on soils that are too wet will result in soil compaction and surface crusting. The crust is hard when it is dry, and it is nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Excessive tillage creates very small and less stable aggregates. Such small particles form crusts and blow and wash away more readily than larger particles.

Adequate surface and subsurface drainage, timely field operations on relatively dry soil, minimum tillage, and maintaining the level of organic matter will improve soil structure and reduce soil compaction and the formation of crusts.

Maintaining good tilth on soils of the survey area is difficult. Tilth can be improved by good drainage, combining field operations, and maintaining and improving the organic matter content of the soil.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*7*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

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

Class I soils have slight limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Soil maps for detailed planning."

Listed at the end of each description of a map unit in the section "Soil maps for detailed planning" is the capability subclass and Michigan soil management group. The soil management groups for the soil complexes are listed in the order of the series named. These groups are used for making recommendations about lime and fertilizer, about artificial drainage, and about other practices. For explanation of these groups refer to Michigan State University Research Report 254 "Soil Management Units and Land Use Planning" (*5*).

The soils are assigned to management groups according to dominant profile texture and natural drainage conditions. Mineral soils are given a number based on the dominant profile texture as follows: 0—fine clay, more than 60 percent clay; 1—clay, 40-60 percent clay; 1.5—clay loam and silty clay loam; 2.5—loam and silt loam; 3—sandy loam; 4—loamy sand; and 5—sand. Soils developed from uniform parent materials are represented by one number. Soils that developed from several parent materials or that have contrasting textures in their profiles are represented by fractions. The numerator represents the texture of the upper layers and the denominator the lower layers. For example, 3/2 represents soils with 20 to 40 inches of sandy loam over loam to silty clay loam.

For alluvial or lowland soils that formed in stratified materials and are subject to flooding, the numbers are preceded by a capital "L." Bedrock is indicated by "R." Soils that are 20 to 40 inches deep over bedrock, for example, might be 3/R—sandy loam over bedrock.

Organic soils are indicated by a capital "M" for muck or peat. Thin, 16 to 51 inch, organic soils are subdivided by characteristics of the underlying mineral materials: M/3—muck over sandy loam to clay loam; M/4—muck over loamy sand or sand; M/m—muck over marl. Thick, deeper than 51 inch, organic soils are given only the symbol "M."

Lower case letters are used after the above letters or numbers to indicate natural drainage conditions: a—well drained and moderately well drained; b—somewhat poorly drained; and c—poorly drained and very poorly drained.

Other soil profile characteristics important to land use planning are indicated by adding a dash and a second lower case letter to the symbol. A lower case "a" after a dash indicates soils with a very strongly acid (pH less than 4.5) subsoil. A lower case "s" indicates stratified fine sands and silts.

Woodland management and productivity

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blow down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and environmental plantings

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

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

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

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are honeysuckle, goldenrod, blackberry, and sumac.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include owls, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and opossum.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper tranches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor*. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 13 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 14 soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 14 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments ar a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops

can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil.

Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*8*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy over loamy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil series and morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*6*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*8*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Adrian series

The Adrian series consists of deep, very poorly drained, organic soils on bogs. These soils are moderately slowly to moderately rapidly permeable. They formed in decomposed, herbaceous plant remains. Slope ranges from 0 to 1 percent.

Adrian soils are similar to Linwood soils and are commonly adjacent to Tobico and Pipestone soils on the landscape. Linwood soils have a loamy IIC horizon. Tobico soils have no organic horizon and are in topographic positions similar to those of the Adrian soils. Pipestone soils have spodic horizons, are somewhat poorly drained, and are above the Adrian soils.

Typical pedon of Adrian muck from an area of Pipestone-Tobico-Adrian complex, 0 to 2 percent slopes, 1,200 feet north and 1,300 feet west of the center of section 29, T. 19 N., R. 13 E.

Oa1—0 to 12 inches; black (10YR 2/1) broken face and rubbed sapric material; about 15 percent fiber, less than 5 percent rubbed; weak fine granular structure; sticky, slightly plastic; many roots; common woody fragments; primarily woody fibers; slightly acid; clear wavy boundary.

Oa2—12 to 18 inches; black (10YR 2/1) broken face and rubbed sapric material; about 25 percent fiber, less than 5 percent rubbed; weak medium platy structure; slightly sticky, slightly plastic; few roots; common woody fragments; primarily herbaceous fibers; slightly acid; abrupt wavy boundary.

Oa3—18 to 28 inches; black (10YR 2/1) broken face and rubbed sapric material; about 10 percent fiber, less than 5 percent rubbed; weak medium platy structure; sticky, slightly plastic; few roots; common woody fragments; primarily herbaceous fibers; neutral; abrupt wavy boundary.

IIC1—28 to 60 inches; olive (5Y 5/3) sand; single grained; about 5 percent pebbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

The depth to the sandy IIC horizon ranges from 16 to 50 inches. Some pedons contain as much as 50 percent woody material in the organic horizons. A few woody fragments of branches and logs up to 6 inches in diameter are throughout the organic horizons of most pedons. The reaction of the organic horizons ranges from medium acid to mildly alkaline.

The surface tier is typically sapric material, but some pedons have stratified hemic and sapric material. The subsurface and bottom tiers have hue of 5YR, 7.5YR, or 10YR; value of 2 or 3; and chroma of 0 through 3. The material is dominantly sapric, but in some pedons there are thin layers of hemic material. The IIC horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. It is sand or gravelly sand.

Aubarque series

The Aubarque series consists of deep, somewhat poorly drained, soils on glacial till plains. These soils are moderately permeable in the upper part and very slowly permeable in the lower part. They formed in loamy, calcareous till. Slope ranges from 0 to 6 percent.

Aubarque soils are similar to Filion soils and are commonly adjacent to Filion, Kilmanagh, and Shebeon soils on the landscape. Filion soils are fine-loamy and poorly drained. Kilmanagh soils are fine-loamy, are poorly drained, and have no horizon with very firm consistence at a depth of less than 24 inches. Filion and Kilmanagh soils are below the Aubarque soils on the landscape.

Shebeon soils are fine-loamy, have argillic horizons, and have no horizon with very firm consistence at a depth of less than 24 inches. Shebeon soils are in topographic positions similar to those of the Aubarque soils.

Typical pedon of Aubarque loam, 0 to 2 percent slopes, 1,540 feet south and 470 feet east of the center of section 30, T. 16 N., R. 16 E.

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) loam; moderate fine granular structure; friable; common roots; about 3 percent pebbles and cobbles; slight effervescence; mildly alkaline; abrupt smooth boundary.

B2—12 to 17 inches; yellowish brown (10YR 5/4) loam; faces of peds are grayish brown (10YR 5/2); common fine prominent yellowish brown (10YR 5/8) mottles; weak thin platy structure parting to weak very fine angular blocky; friable; common roots; about 3 percent pebbles and cobbles; slight effervescence; mildly alkaline; clear wavy boundary.

C1—17 to 32 inches; brown (10YR 5/3) loam; faces of peds are mixed pale brown (10YR 6/3) and grayish brown (10YR 5/2); common fine prominent yellowish brown (10YR 5/6) mottles; strong medium platy structure; very firm; few roots; about 5 percent pebbles and cobbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—32 to 45 inches; pale brown (10YR 6/3) loam; faces of peds are gray (10YR 6/1); few medium prominent yellowish brown (10YR 5/6) mottles; strong thick platy structure; very firm; about 5 percent pebbles and cobbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—45 to 58 inches; brown (10YR 5/3) loam; faces of peds are dark reddish brown (5YR 2/2); few fine prominent yellowish brown (10YR 5/6) mottles; moderate thick platy structure; extremely firm; about 5 percent pebbles and cobbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C4—58 to 60 inches; reddish brown (2.5YR 4/4) loam; faces of peds are dark reddish brown (5YR 2/2) and dark gray (10YR 4/1); weak thick platy structure; extremely firm; about 5 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to a horizon with very firm consistence range from 11 to 24 inches. The depth to free carbonates is 10 inches or less.

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. Reaction is neutral or mildly alkaline. This horizon ranges from 8 to 13 inches in thickness. It is dominantly loam, but the range includes sandy loam and silt loam. The B2 horizon has color chroma of 2 to 4. In some pedons silt loam lenses make up as much as 15 percent of the B2 horizon.

Aurelius series

The Aurelius series consists of deep, very poorly drained soils on bogs. These soils are moderately slowly permeable in the upper part and moderately permeable in the lower part. They formed in decomposed plant remains and marl. Slope ranges from 0 to 1 percent.

Aurelius soils are commonly adjacent to Linwood and Tappan soils on the landscape. Linwood soils have an organic horizon 16 to 50 inches thick and have no marl horizon. Linwood soils are in topographic positions similar to those of the Aurelius soils. Tappan soils lack both organic and marl horizons. Tappan soils are above the Aurelius soils on the landscape.

Typical pedon of Aurelius muck, 1,400 feet south and 350 feet west of the center of section 3, T. 15 N., R. 14 E.

Oa—0 to 8 inches; black (10YR 2/1) broken face and rubbed sapric material; about 5 percent fiber, less than 1 percent rubbed; moderate medium granular structure; friable; many roots; primarily herbaceous fibers; slight effervescence; moderately alkaline; abrupt wavy boundary.

IILca—8 to 24 inches; light gray (10YR 6/1) marl; common fine prominent strong brown (7.5YR 5/6) mottles; massive; friable; few roots; violent effervescence; moderately alkaline; abrupt smooth boundary.

IIIC—24 to 60 inches; yellowish brown (10YR 5/4) sandy loam; many medium prominent gray (10YR 5/1) and common fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; about 6 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Depth to the C horizon ranges from 24 to 40 inches. The Oa horizon ranges from neutral to moderately alkaline. It ranges from 8 to 16 inches in thickness. Areas which have been plowed have varying amounts of marl mixed with the Oa horizon. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 to 4. It is sandy loam or loam with strata of sand and loamy sand in some pedons.

Avoca series

The Avoca series consists of deep, somewhat poorly drained soils on glacial till plains. These soils are rapidly permeable in the upper part and moderately slowly permeable in the lower part. They formed in sandy glacial drift over loamy calcareous till. Slope ranges from 0 to 2 percent.

Avoca soils are similar to Rapson soils and are commonly adjacent to Rapson and Shebeon soils on the landscape. Rapson soils have a stratified fine sand to silty clay loam IIC horizon and are in topographic positions similar to those of the Avoca soils. Shebeon soils are fine-loamy, have argillic horizons, and often surround the low ridges and mounds occupied by the Avoca soils.

Typical pedon of Avoca loamy sand, 0 to 2 percent slopes, 800 feet west and 70 feet north of the southeast corner of section 33, T. 17 N., R. 15 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) loamy sand; very weak medium granular structure; very friable; many roots; medium acid; abrupt wavy boundary.

A2—4 to 6 inches; light brownish gray (10YR 6/2) fine sand; single grained; loose; common roots; medium acid; abrupt irregular boundary.

B21ir—6 to 15 inches; dark brown (7.5YR 4/4) sand; common medium prominent yellowish red (5YR 5/8) mottles; single grained; loose; common roots; neutral; gradual wavy boundary.

B22ir—15 to 24 inches; strong brown (7.5YR 5/6) sand; many medium distinct dark reddish brown (5YR 3/4) mottles; single grained; loose; few roots; neutral; diffuse wavy boundary.

C1—24 to 39 inches; yellowish brown (10YR 5/4) sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; few roots; neutral; abrupt wavy boundary.

IIC2—39 to 60 inches; yellowish brown (10YR 5/4) loam; many coarse distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; about 5 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 18 to 35 inches. Depth to both free carbonates and the loamy IIC horizon ranges from 18 to 40 inches.

Most forested pedons have an O2 horizon. The A1 horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 2 to 5 inches. It is dominantly loamy sand, but the range includes sand. The A2 horizon has value of 5 or 6. It is sand or fine sand. Cultivated pedons have an Ap horizon with hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It ranges in thickness from 8 to 10 inches. The reaction of the A horizon ranges from medium acid to mildly alkaline. The B2 horizon has hue of 7.5YR or 10YR and chroma of 3 to 6. Texture is sand, fine sand, or loamy sand, and the lower part in some pedons is up to 6 percent pebbles. Some pedons have weakly cemented ortstein in the B horizon. The ortstein is up to 30 percent of the horizon. Some pedons have a B3 horizon. The C1 horizon has value of 5 or 6 and chroma of 2 to 4. It is sand or fine sand and is up to 12 percent pebbles. In some pedons this horizon has free carbonates. The IIC horizon has color value of 4 or 5 and chroma of 2 to 4. It is typically loam, but is clay loam or silty clay loam in some pedons.

Bach series

The Bach series consists of deep, poorly drained and very poorly drained soils on glacial lake plains. These soils are moderately slowly permeable or moderately permeable. They formed in calcareous glacio-lacustrine sediments. Slope ranges from 0 to 1 percent. These soils have a lighter colored surface layer than is defined within the range for the Bach series, but this difference does not alter the usefulness or behavior of the soils.

Bach soils are similar to Tappan soils and are commonly adjacent to Gagetown, Sanilac, and Tappan soils on the landscape. Gagetown soils are moderately well drained. Sanilac soils are somewhat poorly drained. Gagetown and Sanilac soils are above the Bach soils on the landscape. Tappan soils are fine-loamy and are in topographic positions similar to those of the Bach soils.

Typical pedon of Bach silt loam, 350 feet north and 45 feet east of the southwest corner of section 20, T. 15 N., R. 10 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 6/2) dry; weak fine subangular blocky structure; friable; few roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

B21g—10 to 18 inches; light brownish gray (10YR 6/2) very fine sandy loam; common medium prominent yellowish brown (10YR 5/6) and few fine faint light gray (10YR 6/1) mottles; weak thin platy structure; friable; slight effervescence; moderately alkaline; abrupt wavy boundary.

B22g—18 to 30 inches; light brownish gray (10YR 6/2) very fine sandy loam; common medium faint pale brown (10YR 6/3) and common medium prominent yellowish brown (10YR 5/6) mottles; weak thin platy structure; friable; slight effervescence; moderately alkaline; abrupt wavy boundary.

C1—30 to 43 inches; pale brown (10YR 6/3) stratified loamy very fine sand and silt loam; common medium distinct light gray (10YR 6/1) and common medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; slight effervescence; moderately alkaline; abrupt wavy boundary.

C2—43 to 60 inches; brown (10YR 5/3) stratified very fine sandy loam and silt loam; common fine prominent yellowish brown (10YR 5/6) and few fine faint light brownish gray (10YR 6/2) mottles; massive; friable; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 24 to 36 inches. Depth to free carbonates is 10 inches or less.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2. Reaction ranges from neutral to moderately alkaline. Thickness of the Ap horizon ranges from 10 to 13 inches. It is dominantly silt loam, but range includes sandy loam and loam. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is dominantly very fine sandy loam, but there are strata of very fine sand, loamy very fine sand, fine sandy loam, loam, silt loam, or silty clay loam in some pedons. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6; and chroma of 1 to 3. The upper part of the C horizon has strata of very fine sand, loamy fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam, silt loam, and silty clay loam. The lower C horizon has, in addition, strata of fine gravel and fine sand. In some pedons loam till is at a depth of more than 40 inches.

Badaxe series

The Badaxe series consists of deep, somewhat poorly drained soils on glacial till plains. These soils are moderately permeable in the upper part and very slowly permeable in the lower part. They formed in calcareous till. Slope ranges from 0 to 3 percent.

Badaxe soils are similar to Corunna soils and are commonly adjacent to Corunna, Kilmanagh, and Shebeon soils on the landscape. Corunna soils have a mollic epipedon and are poorly drained. Kilmanagh soils are fine-loamy and are poorly drained. Corunna and Kilmanagh soils are below the Badaxe soils on the landscape. Shebeon soils are fine-loamy and are in topographic positions similar to those of the Badaxe soils.

Typical pedon of Badaxe fine sandy loam, 0 to 3 percent slopes, 1,100 feet south and 1,545 feet east of the northwest corner of section 22, T. 16 N., R. 15 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak coarse granular structure; very friable; many roots; about 5 percent pebbles and cobbles; neutral; abrupt smooth boundary.

B1—10 to 15 inches; brown (10YR 5/3) loamy sand; weak fine subangular blocky structure; very friable; few roots; about 5 percent pebbles and cobbles; mildly alkaline; abrupt wavy boundary.

B21t—15 to 20 inches; dark yellowish brown (10YR 4/4) loam; many medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of some peds; about 10 percent pebbles and cobbles; mildly alkaline; gradual wavy boundary.

B22t—20 to 27 inches; dark yellowish brown (10YR 4/4) sandy loam; common medium distinct grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; very friable; few roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on vertical and horizontal faces of peds; about 10 percent pebbles and cobbles; mildly alkaline; abrupt wavy boundary.

IIC1—27 to 36 inches; brown (10YR 5/3) loam; common medium distinct gray (10YR 6/1) and common medium prominent yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to weak fine subangular blocky; firm; about 10 percent pebbles and cobbles; strong effervescence; moderately alkaline; diffuse wavy boundary.

IIC2—36 to 60 inches; brown (10YR 5/3) loam; weak thick platy structure; very firm; about 10 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates typically are 20 to 30 inches, but range from 17 to 40 inches. Depth to a horizon with very firm consistence ranges from 25 to 40 inches. Pebbles and cobbles make up 2 to 30 percent of the A horizon and 2 to 18 percent of the rest of the pedon. Reaction of the solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. It ranges in thickness from 6 to 10 inches. It is dominantly cobbly sandy loam, sandy loam, or fine sandy loam, but the range includes loamy sand and loam. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. The IIC horizon has color value of 5 or 6 and chroma of 3 or 4.

Belleville series

The Belleville series consists of deep, poorly drained and very poorly drained soils on glacial till plains. These soils are rapidly permeable in the upper part and moderately slowly permeable in the lower part. They formed in sandy glacial drift over loamy calcareous till. Slope is 0 to 1 percent.

Belleville soils are similar to Essexville soils and are commonly adjacent to Avoca, Corunna, and Granby soils. Essexville soils are calcareous within 10 inches of the surface. Avoca soils have a spodic horizon, are somewhat poorly drained, and are above the Belleville soils on the landscape. Corunna soils are coarse-loamy. Granby soils lack a loamy IIC horizon. Corunna and Granby soils are in topographic positions similar to those of the Belleville soils.

Typical pedon of Belleville loamy sand, 1,240 feet east and 65 feet north of the southwest corner of section 14, T. 16 N., R. 14 E.

Ap—0 to 11 inches; black (10YR 2/1) loamy sand, gray (10YR 5/1) dry; very weak fine subangular blocky structure; very friable; few roots; about 1 percent pebbles and cobbles; mildly alkaline; abrupt smooth boundary.

B2g—11 to 20 inches; grayish brown (2.5YR 5/2) loamy sand; many medium prominent yellowish brown (10YR 5/6) mottles; very weak fine subangular blocky structure; very friable; few roots; about 1 percent pebbles and cobbles; mildly alkaline; gradual wavy boundary.

C1g—20 to 31 inches; light brownish gray (10YR 6/2) sand; many coarse distinct yellowish brown (10YR 5/4) mottles; single grained; loose; about 1 percent pebbles and cobbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

IIC2g—31 to 48 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/4) mottles; very weak medium subangular blocky structure; firm; about 3 percent pebbles and cobbles; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC3g—48 to 60 inches; gray (10YR 5/1) loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium platy structure; firm; about 3 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 20 to 30 inches. Depth to both carbonates and the loamy IIC horizon ranges from 20 to 40 inches. Reaction of the solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 11 to 13 inches. It is dominantly loamy sand, but the range includes sand. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 1 or 2. The C1 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 to 3. The B2 and C1 horizons are sand, fine sand, loamy sand, or loamy fine sand. The IIC horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 to 4. It is typically loam, but is clay loam or silty clay loam in some pedons.

Boyer series

The Boyer series consists of deep, well drained soils on glacial outwash plains, valley trains, and deltas. These soils have moderately rapid permeability in the upper part and rapid permeability in the lower part. They formed in sandy, calcareous glaciofluvial sediments. Slope ranges from 0 to 12 percent.

Boyer soils are similar to Plainfield soils and are commonly adjacent to Covert, Pipestone, Riverdale, and Tobico soils on the landscape. Plainfield soils are sandy. Covert soils are sandy, have a spodic horizon, and are moderately well drained. Covert soils are in topographic positions similar to those of the Boyer soils. Pipestone soils are sandy, have a mottled spodic horizon, and are somewhat poorly drained. Riverdale soils have a mottled argillic horizon and are somewhat poorly drained. Tobico soils are poorly drained and very poorly drained. Riverdale and Tobico soils are below the Boyer soils on the landscape.

Typical pedon of Boyer loamy sand, 0 to 6 percent slopes, 300 feet west and 1,875 feet south of the center of section 28, T. 17 N., R. 13 E.

Ap—0 to 7 inches; dark brown (10YR 4/3) loamy sand; very weak medium granular structure; very friable; common roots; about 10 percent pebbles and cobbles; mildly alkaline; abrupt wavy boundary.

B1—7 to 17 inches; strong brown (7.5YR 5/6) sand; single grained; loose; few roots; about 10 percent pebbles and cobbles; mildly alkaline; abrupt wavy boundary.

B21t—17 to 23 inches; dark brown (7.5YR 4/4) gravelly loam; weak fine subangular blocky structure; friable; few roots; thin discontinuous clay films on faces of peds and considerable bridging of sand grains with clay; about 20 percent pebbles and cobbles; mildly alkaline; abrupt wavy boundary.

B22t—23 to 27 inches; yellowish brown (10YR 5/6) loamy sand; very weak coarse subangular blocky structure; very friable; weak bridging of sand grains with clay; about 5 percent pebbles and cobbles; mildly alkaline; abrupt wavy boundary.

IIC—27 to 60 inches; light yellowish brown (10YR 6/4) stratified sand and gravel; single grained; loose; about 20 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 22 to 40 inches. Pebbles and cobbles make up 1 to 25 percent by volume of the solum and 10 to 35 percent of the IIC horizon. The solum ranges from medium acid to mildly alkaline.

The Ap horizon has color value of 4 or 5 and chroma of 2 or 3. It ranges in thickness from 6 to 12 inches. It is dominantly loamy sand, but the range includes sandy loam. Pedons which have not been cultivated have A1 and A2 horizons. The A1 horizon is typically very dark grayish brown (10YR 3/2). It ranges in thickness from 2 to 5 inches. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It ranges in thickness from 3 to 8 inches. The B2t horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 3 to 6. It is gravelly sandy loam, sandy loam, or gravelly loam. The IIC horizon has chroma of 3 or 4.

Corunna series

The Corunna series consists of deep, poorly drained soils on glacial till plains. These soils are moderately or moderately rapidly permeable in the upper part and moderately slowly permeable in the lower part. They formed in loamy, calcareous till. Slope is 0 to 1 percent.

Corunna soils are similar to Badaxe soils and are commonly adjacent to Badaxe, Kilmanagh, and Tobico soils on the landscape. Badaxe soils have an argillic horizon, are somewhat poorly drained, and are above the Corunna soils. Kilmanagh soils are fine loamy. Tobico soils are sandy. Kilmanagh and Tobico soils are in topographic positions similar to those of Corunna soils.

Typical pedon from an area of Corunna sandy loam, 1,700 feet east and 136 feet south of the northwest corner of section 1, T. 17 N., R. 14 E.

Ap—0 to 11 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; common roots; about 2 percent pebbles and cobbles; mildly alkaline; abrupt smooth boundary.

B21g—11 to 21 inches; gray (10YR 5/1) sandy loam; many medium faint grayish brown and few fine prominent yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; very friable, few roots; about 2 percent pebbles and cobbles; mildly alkaline; clear wavy boundary.

B22—21 to 32 inches; yellowish brown (10YR 5/4) sandy loam; many medium distinct yellowish brown (10YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; weak very fine subangular blocky structure; very friable; about 2 percent pebbles and cobbles; mildly alkaline; gradual wavy boundary.

C1g—32 to 36 inches; grayish brown (10YR 5/2) gravelly sandy loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; very friable; about 15 percent pebbles and cobbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

IIC2g—36 to 40 inches; grayish brown (10YR 5/2) loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; about 4 percent pebbles and cobbles; slight effervescence; moderately alkaline; gradual wavy boundary.

IIC3g—40 to 60 inches; gray (10YR 5/1) loam; few fine prominent yellowish brown (10YR 5/4) mottles; moderate medium platy structure; firm; about 4 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 20 to 40 inches. Depth to the IIC horizon ranges from 26 to 40 inches. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 10 to 12 inches. It is dominantly sandy loam, but the range includes loamy sand and loam. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6; and chroma of 1 to 4. It is loamy fine sand, sandy loam, fine sandy loam, or loam. The C1 horizon has hue of 10YR or 2.5Y and chroma of 2 to 6. It is loamy fine sand, gravelly sandy loam, sandy loam, or loam. The IIC horizon has chroma of 1 to 4. It is typically loam, but is clay loam in some pedons.

Covert series

The Covert series consists of deep, moderately well drained soils on glacial outwash and till plains and dunes. These soils are rapidly permeable, except for the loamy substratum soil, which is rapidly permeable in the upper part and moderately slowly or slowly permeable in the lower part. They formed in sandy glacial drift. Slope ranges from 0 to 6 percent.

Covert soils are similar to Pipestone soils and are commonly adjacent to Tobico, Pipestone, and Plainfield soils on the landscape. Tobico soils have no spodic horizon and are poorly drained. Pipestone soils have a mottled spodic horizon and are somewhat poorly drained. Tobico and Pipestone soils are below the Covert soils on the landscape. Plainfield soils have no spodic horizon, are excessively drained, and are above the Covert soils on the landscape.

Typical pedon of Covert sand, 0 to 2 percent slopes, 225 feet north and 60 feet east of the southwest corner of section 15, T. 17 N., R. 13 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) sand; very weak medium granular structure; very friable; many roots; medium acid; abrupt wavy boundary.

A2—4 to 10 inches; light brownish gray (10YR 6/2) sand; single grained; loose; many roots; medium acid; abrupt irregular boundary.

B2ir—10 to 27 inches; strong brown (7.5YR 5/6) sand; single grained; loose; common roots; neutral; gradual wavy boundary.

B3—27 to 35 inches; brownish yellow (10YR 6/6) sand; few fine distinct strong brown (7.5YR 5/8) and common medium faint strong brown (7.5YR 5/6) mottles; single grained; loose; few roots; neutral; gradual wavy boundary.

C—35 to 60 inches; light yellowish brown (10YR 6/4) sand; single grained; loose; few roots; mildly alkaline.

Thickness of the solum ranges from 24 to 36 inches. Pebble content ranges from 0 to 5 percent. Reaction ranges from medium acid to neutral.

In most forested areas, there is an O2 horizon. The A1 horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 1 to 5 inches. It is dominantly sand, but the range includes fine sand and loamy sand. The A2 horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 1 to 3. It is sand or loamy sand. In cultivated areas, the Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It ranges in thickness from 6 to 10 inches. The B2 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 to 6. In some pedons weakly cemented ortstein is up to 30 percent of the B horizon. The C horizon has chroma of 3 or 4. It is sand or stratified sand and fine sand. In pedons of the loamy substratum phase a IIC horizon is at a depth of 40 to 60 inches. It is typically loam, but is clay loam or silty clay loam in some pedons. The IIC horizon has free carbonates and is moderately alkaline.

Deerton Variant

The Deerton Variant consists of moderately deep, well drained and moderately well drained soils on glacial till plains. These soils are rapidly or moderately rapidly permeable. They formed in sandy, noncalcareous till over sandstone bedrock. Slope ranges from 0 to 4 percent.

Deerton Variant soils are similar to Tyre soils and are commonly adjacent to Mitiwanga and Tyre soils on the landscape. Mitiwanga soils have an argillic horizon, are fine-loamy, and are somewhat poorly drained. Tyre soils have no spodic horizon and are somewhat poorly drained. Mitiwanga and Tyre soils are below the Deerton Variant soils on the landscape.

Typical pedon of Deerton Variant gravelly loamy sand, 0 to 4 percent slopes, 660 feet south and 1,020 feet east of the center of section 11, T. 18 N., R. 13 E.

A1—0 to 3 inches; black (10YR 2/1) gravelly loamy sand; very weak medium granular structure; very friable; many roots; about 20 percent pebbles and cobbles; medium acid; abrupt wavy boundary.

A2—3 to 5 inches; brown (7.5YR 5/2) gravelly coarse sand; single grained; loose; many roots; about 20 percent pebbles and cobbles; medium acid; abrupt wavy boundary.

B21hir—5 to 6 inches; dark brown (7.5YR 3/2) gravelly loamy sand; very weak fine subangular blocky structure; very friable; common roots; about 20 percent pebbles and cobbles; strongly acid; abrupt wavy boundary.

B22ir—6 to 22 inches; brown (7.5YR 4/4) very cobbly coarse sand; single grained; loose; common roots; about 60 percent pebbles and cobbles; medium acid; abrupt irregular boundary.

IIR—22 inches; sandstone bedrock.

Both thickness of the solum and depth to bedrock range from 20 to 40 inches. Pebble and cobble content ranges from 10 to 60 percent in the solum and from 35 to 60 percent in the control section. Fragment size and content increase with depth.

In most forested areas there is an O2 horizon. The A1 horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 2 to 5 inches. It is dominantly gravelly loamy sand but the range includes loamy sand, cobbly sandy loam, or sandy loam. The A2 horizon has hue of 7.5YR or 10YR, value of 5 through 7, and chroma of 2 or 3. It is gravelly coarse sand, coarse sand, gravelly loamy sand, or gravelly fine sandy loam. In cultivated areas the Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It ranges in thickness from 6 to 10 inches. The B2 horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 or 4; and chroma of 2 to 4. It is very cobbly coarse sand, gravelly sand, or gravelly loamy sand. Some pedons have a C horizon with hue of 7.5YR or 10YR, value of 6, and chroma of 3 or 4. It is very cobbly sand and ranges in thickness from 0 to 20 inches. Some pedons have a Cr horizon of fractured and weathered sandstone.

Essexville series

The Essexville series consists of deep, poorly and very poorly drained soils on glacial lake and till plains. These soils are rapidly permeable in the upper part and moderately slowly permeable in the lower part. They formed in sandy glacial drift over loamy, calcareous till. Slope is 0 to 1 percent.

Essexville soils are similar to Belleville soils and are commonly adjacent to Avoca and Tappan soils on the landscape. Belleville soils are not calcareous within 10 inches of the surface. Avoca soils have a spodic horizon, are somewhat poorly drained, and are above the Essexville soils. Tappan soils are fine-loamy and are in topographic positions similar to those of the Essexville soils.

Typical pedon of Essexville loamy sand, 600 feet east and 2,400 feet north of the center of section 18, T. 15 N., R. 9 E.

Ap—0 to 12 inches; black (10YR 2/1) loamy sand, grayish brown (10YR 5/2) dry; very weak medium subangular blocky structure; very friable; few roots; about 2 percent pebbles; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1g—12 to 22 inches; light brownish gray (2.5YR 6/2) sand; few fine distinct yellowish brown (10YR 5/4) mottles; single grained; loose; about 10 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

IIC2g—22 to 60 inches; grayish brown (10YR 5/2) loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; about 4 percent pebbles and cobbles; strong effervescence; moderately alkaline.

The depth to the IIC horizon ranges from 18 to 40 inches. Depth to free carbonates is 10 inches or less.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 11 to 14 inches. It is dominantly loamy sand, but the range includes sand. The C1 horizon has value of 4 to 6 and chroma of 1 or 2. The C1 horizon is sand, fine sand, loamy sand, or loamy fine sand. The IIC horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is loam or clay loam.

Filion series

The Filion series consists of deep, poorly drained soils on glacial till plains. These soils are moderately or moderately slowly permeable in the upper part and very slowly permeable in the lower part. They formed in loamy, calcareous till. Slope ranges from 0 to 1 percent.

Filion soils are similar to Aubarque soils and are commonly adjacent to Aubarque soils on the landscape. Aubarque soils are coarse-loamy, are somewhat poorly drained, and are above the Filion soils.

Typical pedon of Filion stony loam, 1,100 feet east and 660 feet south of northwest corner of section 1, T. 16 N., R. 15 E.

A1—0 to 5 inches; very dark gray (10YR 3/1) stony loam; moderate fine granular structure; friable; many roots; about 15 percent cobbles and pebbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

B2g—5 to 14 inches; gray (10YR 5/1) loam; common medium distinct olive (5Y 5/3) and few fine prominent dark yellowish brown (10YR 5/5) mottles; weak fine subangular blocky structure; firm; few roots; about 7 percent cobbles and pebbles; slight effervescence; moderatley alkaline; abrupt wavy boundary.

C1g—14 to 32 inches; olive gray (5Y 5/2) loam; faces of peds are gray (5Y 5/1); many coarse distinct gray (5Y 5/1) mottles; strong very thick platy structure; very firm; about 5 percent cobbles and pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C2g—32 to 54 inches; olive gray (5Y 5/2) clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles; massive; very firm; about 5 percent cobbles and pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

C3g—54 to 60 inches; gray (N 5/0) loam; very firm; about 5 percent cobbles and pebbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to a horizon with very firm consistence range from 12 to 24 inches. Cobble and pebble content ranges from 10 to 30 percent in the solum and from 2 to 20 percent in the C horizon. Depth to free carbonates is 10 inches or less.

The A1 horizon has color value of 2 or 3 and chroma of 1 or 2. Reaction ranges from neutral to moderately alkaline. Thickness of the A1 horizon ranges from 4 to 7 inches. It is dominantly stony loam, but the range includes stony sandy loam, sandy loam, or loam. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 1 or 2. Some pedons have thin subhorizons of silt loam. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 0 to 2.

Gagetown series

The Gagetown series consists of deep, moderately well drained soils on glacial lake plains. These soils are moderately or moderately slowly permeable. They formed in silty, calcareous, glacio-lacustrine sediments. Slope ranges from 0 to 4 percent.

Gagetown soils are similar to Sanilac soils and are commonly adjacent to Grindstone and Sanilac soils on the landscape. Grindstone soils are fine-loamy, have an argillic horizon, and are in topographic positions similar to those of the Gagetown soils. Sanilac soils have no mollic epipedon, are somewhat poorly drained, and are below the Gagetown soils.

Typical pedon of Gagetown silt loam, 0 to 4 percent slopes, 980 feet north and 210 feet east of the southwest corner of section 5, T. 18 N., R. 13 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam; grayish brown (10YR 5/2) dry; weak very thick platy structure parting to weak medium subangular blocky; friable; many roots; mildly alkaline; clear wavy boundary.

B2—9 to 12 inches; dark yellowish brown (10YR 4/4) silt loam; some faces of peds are dark brown (10YR 4/3); common medium distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to weak very fine subangular blocky; friable; common roots; some mixing of Ap material into upper 1 to 2 inches by earthworms; mildly alkaline; clear broken boundary.

C—12 to 60 inches; yellowish brown (10YR 5/4) stratified very fine sand and silt loam, common medium faint pale brown (10YR 6/3) and common medium distinct brownish yellow (10YR 6/6) mottles; weak thin platy structure; very friable; few roots; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 10 to 16 inches. The depth to free carbonates ranges from 0 to 16 inches.

The Ap horizon has color chroma of 1 or 2. It ranges in thickness from 7 to 10 inches. It is fine sandy loam, silt loam, or loam. The B2 horizon is silt loam or very fine sandy loam. The C horizon of some pedons has thin strata of clay loam or silty clay loam below a depth of 20 inches. In some pedons it has mottles with value of 4 or 5 and chroma of 1 or 2 below a depth of 18 inches.

Granby series

The Granby series consists of deep, poorly drained and very poorly drained soils on glacial outwash and till plains. These soils are rapidly permeable. They formed in sandy glacial drift. Slope is 0 to 1 percent.

Granby soils are commonly adjacent to Belleville and Pipestone soils on the landscape. Belleville soils have a loamy IIC horizon and are in topographic positions similar to those of Granby soils. Pipestone soils have spodic horizons, are somewhat poorly drained, and are above the Granby soils.

Typical pedon of Granby loamy sand, 100 feet north and 1,400 feet west of the southeast corner of section 27, T. 16 N., R. 14 E.

Ap—0 to 11 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; weak, very fine subangular blocky structure; very friable; neutral; abrupt smooth boundary.

B2g—11 to 22 inches; grayish brown (2.5Y 5/2) sand; few fine distinct brown (10YR 5/3) mottles; single grained; loose; neutral; clear wavy boundary.

B3g—22 to 31 inches; grayish brown (10YR 5/2) sand; common medium prominent yellowish brown (10YR 5/6) mottles; single grained; loose; neutral; clear wavy boundary.

C1—31 to 41 inches; brown (10YR 5/3) sand; common medium faint grayish brown (10YR 5/2) mottles; single grained; loose; slight effervescence; moderately alkaline; clear wavy boundary.

C2g—41 to 60 inches; gray (5Y 5/1) fine sand; single grained; loose; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 24 to 40 inches. Reaction ranges from medium acid to neutral in the upper 30 inches and from neutral to moderately alkaline at a depth of 30 to 60 inches.

The Ap horizon has color value of 2 or 3 and chroma of 0 to 2. It ranges in thickness from 10 to 13 inches. It is dominantly loamy sand, but the range includes sand or sandy loam. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 through 6; and chroma of 0 through 3. It is sand, fine sand, loamy sand, or loamy fine sand. Some pedons have thin strata of sandy loam to sandy clay loam in the B and C horizons. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7; and chroma of 1 to 4.

Grindstone series

The Grindstone series consists of deep, moderately well drained soils on glacial till plains. These soils are moderately permeable in the upper part and very slowly permeable in the lower part. They formed in loamy, calcareous till. Slope ranges from 0 to 4 percent.

Grindstone soils are similar to Guelph soils and are commonly adjacent to Gagetown and Shebeon soils on the landscape. Guelph soils do not have a very slowly permeable C horizon. Gagetown soils are coarse-silty, have a mollic epipedon, and are in topographic positions similar to those of the Grindstone soils. Shebeon soils are dominantly grayer in the lower B horizon than Grindstone soils, are somewhat poorly drained, and are below the Grindstone soils.

Typical pedon of Grindstone loam, 0 to 4 percent slopes, 1,210 feet north and 1,180 feet west of the center of section 32, T. 19 N., R. 13 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; moderate fine granular structure; friable; common roots; about 2 percent pebbles and cobbles; neutral; abrupt smooth boundary.

B&A—9 to 11 inches; yellowish brown (10YR 5/4) clay loam (B2t) with coatings of pale brown (10YR 6/3) sandy loam (A2) more than 2 mm thick between vertical faces of peds; common fine prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; few roots; thin discontinuous clay films; about 2 percent pebbles and cobbles; mildly alkaline; abrupt irregular boundary.

B2t—11 to 20 inches; brown (10YR 5/3) clay loam; few fine faint grayish brown (10YR 5/2) and common fine prominent yellowish brown (10YR 5/6) mottles in lower part of horizon; weak medium prismatic structure parting to moderate medium angular blocky; firm; few roots; thin continuous dark brown (10YR 4/3) clay films on vertical faces of peds and thin discontinuous clay films on horizontal faces; about 2 percent pebbles and cobbles; mildly alkaline; clear wavy boundary.

B3—20 to 27 inches; light yellowish brown (10YR 6/4) silt loam; few fine distinct yellowish brown (10YR 5/6) and common medium prominent gray (10YR 6/1) mottles; weak fine subangular blocky structure; friable; few roots; about 3 percent pebbles and cobbles; strong effervescence; moderately alkaline; clear wavy boundary.

C1—27 to 55 inches; brown (10YR 5/3) loam; strong thick platy structure; very firm; about 4 percent pebbles and cobbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—55 to 60 inches; brown (10YR 5/3) loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate thick platy structure; very firm; about 4 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 12 to 33 inches. Depth to free carbonates ranges from 12 to 25 inches. The depth to a horizon with very firm consistence ranges from 24 to 40 inches. Pebble and cobble content ranges from 2 to 25 percent in the A horizon and 2 to 18 percent in the rest of the pedon.

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. It ranges in thickness from 6 to 10 inches. It is dominantly loam or cobbly loam, but the range includes loamy sand, sandy loam, or silt loam. The B2 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. It is loam or clay loam. The C horizon has value of 5 or 6 and chroma of 3 or 4.

Guelph series

The Guelph series consists of deep, well drained and moderately well drained soils on moraines. These soils are moderately permeable. They formed in loamy, calcareous till. Slope ranges from 2 to 18 percent.

Guelph soils are similar to Grindstone soils and are commonly adjacent to Londo and Parkhill soils on the landscape. Grindstone soils have a very slowly permeable C horizon. Londo soils are somewhat poorly drained. Parkhill soils lack an argillic horizon and are poorly drained. Londo and Parkhill soils are below the Guelph soils on the landscape.

Typical pedon of Guelph loam from an area of Guelph-Londo loams, 2 to 6 percent slopes, 270 feet north and 1,650 feet east of the southwest corner of section 27, T. 16 N., R. 13 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; few roots; about 2 percent pebbles and cobbles; neutral; abrupt smooth boundary.

B&A—9 to 13 inches; dark brown (7.5YR 4/4) clay loam (B2t) with coatings of pale brown (10YR 6/3) sandy loam (A2) greater than 2 mm thick between vertical faces of peds; weak very fine angular blocky structure; friable; few roots; thin discontinuous clay films; about 2 percent pebbles and cobbles; slightly acid; clear broken boundary.

B2t—13 to 21 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium angular blocky structure; firm; thick continuous dark brown (7.5YR 3/2) clay films on faces of peds; about 2 percent pebbles and cobbles; mildly alkaline; gradual irregular boundary.

C1—21 to 29 inches; dark brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; thin discontinuous clay films; about 2 percent pebbles and cobbles; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—29 to 60 inches; brown (10YR 5/3) loam; weak medium subangular blocky structure; friable; about 4 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 15 to 25 inches.

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. Reaction ranges from slightly acid to mildly alkaline. The Ap horizon ranges from 7 to 10 inches thick. It is dominantly loam but ranges to sandy loam. The B2 horizon has hue of 7.5YR or 10YR and value and chroma of 3 or 4. Reaction is neutral or mildly alkaline. The C horizon has value of 4 to 6 and chroma of 3 or 4.

Kilmanagh series

The Kilmanagh series consists of deep, poorly drained soils on glacial till plains. These soils are moderately permeable in the upper part and very slowly permeable in the lower part. They formed in loamy, calcareous till. Slope is 0 to 1 percent.

Kilmanagh soils are similar to Parkhill soils and are commonly adjacent to Avoca, Badaxe, and Shebeon soils on the landscape. Parkhill soils do not have a very slowly permeable C horizon. Avoca soils have a sandy solum, have a spodic horizon, and are somewhat poorly drained. Badaxe soils have an argillic horizon, are coarse-loamy, and are somewhat poorly drained. Shebeon soils have an argillic horizon and are somewhat poorly drained. Avoca, Badaxe, and Shebeon soils are above the Kilmanagh soils on the landscape.

Typical pedon of Kilmanagh loam, 160 feet south and 1,960 feet west of the northeast corner of section 26, T. 16 N., R. 10 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loam; weak fine subangular blocky structure; friable; few roots; about 3 percent pebbles and cobbles; mildly alkaline; abrupt smooth boundary.

B21g—9 to 26 inches; gray (10YR 5/1) loam; common medium prominent dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; few roots; about 3 percent pebbles and cobbles; mildly alkaline; clear wavy boundary.

B22—26 to 29 inches; dark yellowish brown (10YR 4/4) loam; common medium prominent gray (5Y 5/1) mottles; weak fine subangular blocky structure; friable; about 3 percent pebbles and cobbles; mildly alkaline; clear wavy boundary.

C1—29 to 44 inches; dark yellowish brown (10YR 4/4) loam; common medium prominent gray (5Y 5/1) and few medium distinct light brownish gray (10YR 6/2) mottles; very weak fine angular blocky structure; friable; about 5 percent pebbles and cobbles; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—44 to 60 inches; brown (10YR 5/3) loam; many medium faint dark yellowish brown (10YR 4/4) and many medium distinct gray (5Y 5/1) mottles; massive; very firm; about 5 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates are typically 28 to 36 inches and range from 11 to 44 inches. Depth to a horizon with very firm consistence ranges from 24 to 50 inches. Pebble and cobble content ranges from 2 to 30 percent in the A horizon and from 2 to 18 percent in the rest of the pedon. Reaction of the solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color chroma of 1 or 2. It ranges in thickness from 7 to 12 inches. It is dominantly loam or cobbly loam, but the range includes sandy loam and clay loam. The B2 horizon has chroma of 1 to 4.

Linwood series

The Linwood series consists of deep, very poorly drained, organic soils on bogs. These soils are moderately slowly to moderately rapidly permeable in the upper part and moderately permeable in the lower part. They formed in decomposed woody plant remains. Slope is 0 to 1 percent.

Linwood soils are similar to Adrian soils and are commonly adjacent to Aurelius and Pinnebog soils on the landscape. Adrian soils have a sandy IIC horizon. Aurelius soils have a marl horizon. Pinnebog soils have no mineral horizon at a depth of less than 51 inches. Aurelius and Pinnebog soils are in topographic positions similar to those of the Linwood soils.

Typical pedon of Linwood muck, 750 feet west and 1,850 feet north of the southeast corner of section 17, T. 16 N., R. 13 E.

Oa1—0 to 9 inches; black (10YR 2/1) broken face and rubbed sapric material; about 10 percent fiber, 5 percent rubbed; moderate medium granular structure; very friable; many roots; primarily woody fibers; about 5 percent coarse woody fragments; mildly alkaline; clear wavy boundary.

Oa2—9 to 18 inches; black (10YR 2/1) broken face and rubbed sapric material; about 40 percent fiber, 5 percent rubbed; moderate coarse subangular blocky structure; friable; few roots; primarily woody fibers; about 5 percent coarse woody fragments; mildly alkaline; gradual wavy boundary.

Oa3—18 to 25 inches; black (5YR 2/1) broken face, dark reddish brown (5YR 2/2) rubbed sapric material; about 30 percent fiber, 5 percent rubbed; moderate thick platy structure; friable; primarily woody fibers; about 5 percent coarse woody fragments; mildly alkaline; clear wavy boundary.

IICg—25 to 60 inches; gray (10YR 5/1) loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; few snail shells; strong effervescence; moderately alkaline.

The depth to the IIC horizon ranges from 16 to 50 inches. The reaction of the organic horizons ranges from medium acid to mildly alkaline.

The organic part of the subsurface and bottom tiers has hue of 5YR, 7.5YR, or 10YR; value of 2 or 3; and chroma of 0 to 3. The material is dominantly sapric, but in some pedons there are thin layers of hemic material that have a combined thickness of less than 10 inches. The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is sandy loam through silty clay loam. Some pedons have strata of sand or loamy sand less than 10 inches thick.

Londo series

The Londo series consists of deep, somewhat poorly drained soils on moraines and glacial till plains. These soils are moderately or moderately slowly permeable. They formed in loamy calcareous till. Slope ranges from 0 to 2 percent.

Londo soils in Huron County do not have an albic horizon tonguing into the argillic horizon as is typical of the Londo series elsewhere. This difference, however, does not alter the use or characteristic behavior of the soils.

Londo soils are similar to Shebeon soils, or are commonly adjacent to Geulph and Parkhill soils on the landscape. Shebeon soils have a very slowly permeable C horizon. Guelph soils are well drained and moderately well drained and are above the Londo soils. Parkhill soils have no argillic horizon, are poorly drained, and are below the Londo soils.

Typical pedon of Londo loam, 0 to 2 percent slopes, 725 feet north and 312 feet east of the southwest corner of section 36, T. 15 N., R. 12 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; few roots; about 2 percent pebbles and cobbles; neutral; abrupt wavy boundary.

B&A—9 to 14 inches; yellowish brown (10YR 5/4) loam (B2t) with coatings of grayish brown (10YR 5/2) sandy loam (A2) greater than 2 mm thick between vertical faces of peds; few fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; thin discontinuous clay films; few roots; about 2 percent pebbles and cobbles; neutral; clear wavy boundary.

B2t—14 to 20 inches; brown (10YR 5/3) clay loam; faces of peds are mixed grayish brown (10YR 5/2) and brown (10YR 4/3); common fine prominent yellowish brown (10YR 5/8) and common fine faint light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; thin continuous clay films; about 2 percent pebbles and cobbles; neutral; clear wavy boundary.

C—20 to 60 inches; brown (10YR 5/3) loam; many medium prominent yellowish brown (10YR 5/8) and many fine prominent light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; about 5 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 16 to 25 inches.

The Ap horizon has color value of 3 or 4 and chroma of 1 or 2. It ranges in thickness from 7 to 12 inches. It is dominantly loam, but the range includes loamy sand and sandy loam. The B2 horizon has value or 3 to 5 and chroma of 3 or 4. The C horizon has chroma of 3 or 4.

Mitiwanga series

The Mitiwanga series consists of moderately deep, somewhat poorly drained soils on glacial till plains. These soils are moderately permeable. They formed in loamy noncalcareous till over sandstone bedrock. Slope ranges from 0 to 3 percent.

Mitiwanga soils are commonly adjacent to Deerton Variant, Shebeon soils, and Tyre soils on the landscape. Deerton Variant soils are sandy, have a spodic horizon, and are moderately well drained and well drained. Deerton Variant soils are above the Mitiwanga soils. Shebeon soils have no bedrock at depths of less than 60 inches. Tyre soils are sandy. Shebeon and Tyre soils are in topographic positions similar to those of the Mitiwanga soils.

Typical pedon of Mitiwanga cobbly sandy loam 0 to 3 percent slopes, 290 feet west and 720 feet north of the southeast corner of section 23, T. 18 N., R. 14 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) cobbly sandy loam; weak fine subangular blocky structure; friable; many roots; about 15 percent cobbles and pebbles; slightly acid; abrupt smooth boundary.

A2—7 to 12 inches; brown (10YR 5/3) sandy loam; few medium prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few roots; about 10 percent cobbles and pebbles; neutral; clear wavy boundary.

B2tg—12 to 23 inches; yellowish brown (10YR 5/4) loam; faces of peds are grayish brown (10YR 5/2) with many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; thin discontinuous clay films; about 15 percent cobbles and pebbles; neutral; abrupt wavy boundary.

IIR—23 inches; sandstone bedrock.

Thickness of the solum and depth to bedrock range from 20 to 40 inches. Coarse fragments make up 5 to 25 percent, by volume, of the soil material and generally increase with depth.

Thickness of the Ap horizon ranges from 6 to 10 inches. It is dominantly cobbly sandy loam but the range includes loamy sand, loam, sandy loam, or loam. In areas that have not been plowed, the A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 2. It averages about 4 inches in thickness. The B2 horizon has value of 4 or 5 and chroma of 2 to 4. It is loam or clay loam and averages between 24 and 30 percent clay.

Parkhill series

The Parkhill series consists of deep, poorly and very poorly drained soils on moraines and glacial till plains. These soils are moderately slowly permeable. They formed in loamy calcareous till. Slope is 0 to 1 percent.

Parkhill soils are similar to Kilmanagh soils and are commonly adjacent to Guelph and Londo soils on the landscape. Kilmanagh soils have a very slowly permeable C horizon. Guelph soils have an argillic horizon and are well drained and moderately well drained. Londo soils have an argillic horizon and are somewhat poorly drained. Guelph and Londo soils are above the Parkhill soils.

Typical pedon of Parkhill loam, 640 feet south and 1,900 feet west of the northeast corner of section 25, T. 15 N., R. 11 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few roots; about 2 percent pebbles and cobbles; neutral; abrupt smooth boundary.

B2g—9 to 32 inches; grayish brown (10YR 5/2) loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; about 2 percent pebbles and cobbles; clear wavy boundary.

C1g—32 to 50 inches; grayish brown (10YR 5/2) loam; many medium prominent yellowish brown (10YR 5/6) and few medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; about 2 percent pebbles and cobbles; slight effervescence; moderately alkaline; clear wavy boundary.

C2g—50 to 60 inches; grayish brown (10YR 5/2) loam; common medium prominent light olive brown (2.5Y 5/6) mottles; weak coarse subangular blocky structure; firm; about 5 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates are typically about 30 inches and range from 20 to 45 inches. Reaction of the solum is slightly acid or neutral.

The Ap horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 7 to 10 inches. It is dominantly loam, but the range includes sandy loam and silt loam. The B2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. The C horizon has value of 5 or 6 and chroma of 1 to 4.

Pinnebog series

The Pinnebog series consists of deep, very poorly drained, organic soils on bogs. These soils are moderately or moderately rapidly permeable. They formed in decomposed herbaceous plant remains. Slope is 0 to 1 percent.

Pinnebog soils are commonly adjacent to Linwood and Tobico soils on the landscape. Linwood soils have mineral horizons at a depth of 16 to 50 inches. Tobico soils have no organic horizon. Linwood and Tobico soils are in topographic positions similar to those of the Pinnebog soils.

Typical pedon of Pinnebog muck, 238 feet west and 2,450 feet north of the southeast corner of section 25, T. 16 N., R. 13 E.

Oa1—0 to 16 inches; black (10YR 2/1) broken face and rubbed sapric material; about 15 percent fiber, less than 5 percent rubbed; weak medium granular structure; friable; primarily herbaceous fibers; mildly alkaline; gradual smooth boundary.

Oa2—16 to 34 inches; black (5YR 2/1) broken face and rubbed sapric material; about 35 percent fiber, less than 10 percent rubbed; weak thick platy structure; friable; primarily herbaceous fibers; mildly alkaline; gradual smooth boundary.

Oe1—34 to 50 inches; dark reddish brown (5YR 2/2) broken face and rubbed hemic material; about 90 percent fiber; about 40 percent rubbed; weak thick platy structure; primarily herbaceous fibers; mildly alkaline; abrupt smooth boundary.

Oa3—50 to 60 inches; dark reddish brown (5YR 2/2) broken face, black (5YR 2/1) rubbed sapric material; about 20 percent fiber, less than 5 percent rubbed; weak coarse subangular blocky structure; primarily herbaceous fibers; mildly alkaline.

The organic layers are 51 inches or more in thickness. The organic material has hue of 5YR, 7.5YR, or 10YR and value and chroma of 1 through 3. Woody fragments are throughout the organic layers of most pedons. Reaction ranges from medium acid to mildly alkaline.

The surface tier is typically sapric material but in some pedons it is stratified sapric and hemic material. Some pedons have mineral horizons at a depth of 51 to 60 inches.

Pipestone series

The Pipestone series consists of deep, somewhat poorly drained soils on glacial outwash, till plains, and dunes. These soils are rapidly permeable. They formed in sandy glacial drift. Slope ranges from 0 to 2 percent.

Pipestone soils are similar to Covert soils and are commonly adjacent to Adrian, Covert, and Tobico soils on the landscape. Adrian soils have organic horizons 16 to 50 inches thick, are very poorly drained, and are below the Pipestone soils. Covert soils have no mottles in the upper spodic horizons, are moderately well drained, and are above the Pipestone soils. Tobico soils have no spodic horizon, are poorly drained, and are below the Pipestone soils.

Typical pedon of Pipestone sand, 0 to 2 percent slopes, 1,500 feet north and 200 feet west of the southeast corner of section 16, T. 17 N., R. 13 E.

A1—0 to 2 inches; black (N 2/0) sand; very weak fine granular structure; very friable; many roots; very strongly acid; abrupt wavy boundary.

A2—2 to 10 inches; light brownish gray (10YR 6/2) sand; single grained; loose; common roots; strongly acid; abrupt irregular boundary.

B21hir—10 to 18 inches; strong brown (7.5YR 5/6) and dark brown (7.5YR 3/2) sand; many coarse distinct yellowish red (5YR 4/8) mottles; single grained; loose; common roots; strongly acid; gradual wavy boundary.

B22ir—18 to 36 inches; brown (7.5YR 5/4) sand; common coarse distinct strong brown (7.5YR 5/6) mottles; single grained; loose; few roots; strongly acid; gradual wavy boundary.

C1—36 to 40 inches; light yellowish brown (10YR 6/4) sand; many coarse prominent strong brown (7.5YR 5/8) mottles; single grained; loose; few roots; slightly acid; diffuse wavy boundary.

C2—40 to 60 inches; pale brown (10YR 6/3) sand; common medium faint grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; single grained; loose; slightly acid.

Thickness of the solum ranges from 24 to 40 inches. Pebble content, by volume, ranges from 0 to 5 percent. Reaction of the pedon ranges from very strongly acid to neutral.

In most forested areas, there is an O2 horizon. The A1 horizon has color value of 2 or 3 and chroma of 0 to 2. It ranges in thickness from 2 to 5 inches. It is dominantly sand, but the range includes loamy sand and loamy fine sand. The A2 horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 1 to 3. It is sand, fine sand, or loamy sand. In cultivated areas the Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It ranges in thickness from 6 to 10 inches. The B2 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 6. It is sand, fine sand, or loamy sand. In some pedons weakly cemented orstein ranges from 0 to 30 percent of the B horizon. Some pedons have a B3 horizon. The C horizon has value of 5 or 6 and chroma of 2 to 4. It is sand or fine sand.

Plainfield series

The Plainfield series consists of deep, excessively drained soils on glacial outwash and till plains and dunes. These soils are rapidly permeable. They formed in sandy glacial drift. Slope ranges from 0 to 12 percent.

Plainfield soils are similar to Boyer soils and are commonly adjacent to Covert, Tobico, and Pipestone soils on the landscape. Boyer soils are coarse-loamy. Covert soils have spodic horizons and are moderately well drained. Tobico soils are poorly drained. Pipestone soils have spodic horizons and are somewhat poorly drained Covert, Tobico, and Pipestone soils are below the Plainfield soils on the landscape.

Typical pedon of Plainfield sand from an areas of Plainfield-Covert sands, 2 to 12 percent slopes, 300 feet north and 1,320 feet east of the center of section 14, T. 18 N., R. 11 E.

O2—1 inch to 0; black (10YR 2/1) partially decomposed leaves, twigs, and sand; weak fine granular structure; very friable; many roots; strongly acid; abrupt wavy boundary.

A1—0 to 1 inch; very dark brown (10YR 2/2) sand; some light brownish gray (10YR 6/2) sand (A2); very weak medium granular structure; very friable; many roots; strongly acid; abrupt wavy boundary.

B21—1 inch to 3 inches; yellowish brown (10YR 5/4) sand; single grained; loose; common roots; strongly acid; clear wavy boundary.

B22—3 to 12 inches; yellowish brown (10YR 5/6) sand; single grained; loose; common roots; slightly acid; gradual wavy boundary.

B3—12 to 20 inches; brownish yellow (10YR 6/6) sand; single grained; loose; few roots; slightly acid; diffuse wavy boundary.

C—20 to 60 inches; light yellowish brown (10YR 6/4) sand; single grained; loose; few roots; mildly alkaline.

Thickness of the solum ranges from 18 to 30 inches. Reaction of the upper part of the solum is strongly acid or medium acid. Reaction of the lower part of the solum and the C horizon ranges from slightly acid to mildly alkaline.

The A1 horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 1 to 3 inches. It is dominantly sand, but its range includes fine sand or loamy sand. The A2 horizon, where present, has value of 5 or 6 and chroma of 2 or 3. It ranges in thickness from 0 to 4 inches. In cultivated areas the Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It ranges in thickness from 6 to 10 inches. The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The C horizon has chroma of 3 or 4. It is typically sand, but is stratified sand and fine sand in some pedons.

Rapson series

The Rapson series consists of deep, somewhat poorly drained soils on glacial outwash, till, and lake plains. These soils are rapidly permeable in the upper part and moderately permeable in the lower part. They formed in sandy glacial drift over loamy glaciolacustrine sediments. Slope ranges from 0 to 2 percent.

Rapson soils are similar to Avoca soils and are commonly adjacent to Avoca and Bach soils on the landscape. Avoca soils have a loam to silty clay loam IIC horizon and are in topographic positions similar to those of the Rapson soils. Bach soils have a mollic epidedon, are poorly and very poorly drained, and are below the Rapson soils.

Typical pedon of Rapson loamy sand, 0 to 2 percent slopes, 1,395 feet south and 30 feet east of the northwest corner of section 14, T. 16 N., R. 15 E.

A1—0 to 4 inches; black (10YR 2/1) loamy sand; weak fine granular structure; very friable; common roots; about 2 percent pebbles; slightly acid; abrupt wavy boundary.

A2—4 to 9 inches; light brownish gray (10YR 6/2) sand; single grained; loose; few roots; about 2 percent pebbles; neutral; abrupt irregular boundary.

B2ir—9 to 14 inches; dark brown (7.5YR 4/4) loamy sand; common medium distinct yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; very friable; common roots; about 2 percent pebbles; neutral; abrupt wavy boundary.

B3—14 to 25 inches; yellowish brown (10YR 5/4) sand; common medium distinct yellowish brown (10YR 5/6) and common medium prominent strong brown (7.5YR 5/8) mottles; single grained; loose; few roots; about 5 percent pebbles; mildly alkaline; abrupt wavy boundary.

IIC1—25 to 56 inches; light olive brown (2.5Y 5/4) stratified silt loam, very fine sand, and fine sand; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; very friable; strong effervescence; moderately alkaline; clear wavy boundary.

IIC2g—56 to 60 inches; gray (5Y 5/1) stratified very fine sand, silt loam, and silty clay loam; many coarse prominent light olive brown (2.5Y 5/4) mottles; massive; friable; about 2 percent pebbles; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 20 to 35 inches. Depth to free carbonates and thickness of the sand horizons ranges from 20 to 40 inches. The texture of the solum is sand, fine sand, loamy sand, or loamy fine sand. Solum reaction ranges from medium acid to mildly alkaline.

There is an O2 horizon in most forested areas. The A1 horizon has value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 2 to 5 inches. It is dominantly loamy sand, but the range includes sand. The A2 horizon has value of 5 or 6. It ranges in thickness from 0 to 6 inches. In cultivated areas the Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It ranges in thickness from 8 to 10 inches. The B2 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 6. Weakly cemented ortstein makes up 0 to 30 percent of the B horizon. In some pedons the C1 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is sand, fine sand, loamy sand, or loamy fine sand. Reaction of the C1 horizon is neutral or mildly alkaline. The IIC horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 to 4.

Riverdale series

The Riverdale series consists of deep, somewhat poorly drained soils on glacial outwash plains, valley trains, and deltas. These soils are moderately rapidly permeable. They formed in sandy, calcareous glaciofluvial sediments. Slope ranges from 0 to 2 percent.

Riverdale soils are similar to Wasepi soils and are commonly adjacent to Boyer, Guelph, and Pipestone soils on the landscape. Wasepi soils have an argillic horizon at a depth of less than 20 inches. Boyer soils have no mottled argillic horizon and are well drained. Guelph soils are fine-loamy and are well drained and moderately well drained. Boyer and Guelph soils are above the Riverdale soils. Pipestone soils have a spodic horizon and are in topographic positions similar to those of the Riverdale soils.

Typical pedon of Riverdale loamy sand from an area of Riverdale-Pipestone complex, 0 to 2 percent slopes, 2,000 feet south and 320 feet west of the center of section 23, T. 16 N., R. 13 E.

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

B1—9 to 21 inches; yellowish brown (10YR 5/6) loamy sand; common medium distinct dark brown (7.5YR 4/4) mottles; very weak fine subangular blocky structure; very friable; few roots; about 2 percent pebbles; neutral; clear wavy boundary.

B2t—21 to 25 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; few roots; thin discontinuous clay films on faces of peds and some bridging of sand grains with clay; about 20 percent pebbles; mildly alkaline; clear wavy boundary.

IIC—25 to 60 inches; brown (10YR 5/3) stratified sand and gravel; single grained; loose; about 25 percent pebbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 24 to 40 inches. Pebble content, by volume, ranges from 2 to 25 percent in the solum and from 2 to 30 percent in the IIC horizon. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color value of 2 to 4 and chroma of 2 or 3. It ranges in thickness from 6 to 10 inches. It is dominantly loamy sand, but the range includes sand. In areas that have not been cultivated there are A1 and A2 horizons. The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. It ranges in thickness from 3 to 5 inches. The A2 horizon has value of 5 or 6 and chroma of 2 or 3. It ranges in thickness from 3 to 8 inches. The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is gravelly sandy loam or sandy loam and has thin layers of loamy sand in some pedons. Thickness of the B2t horizon ranges from 4 to 6 inches. The IIC horizon has value of 5 or 6 and chroma of 2 or 3.

Sanilac series

The Sanilac series consists of deep, somewhat poorly drained soils on glacial lake plains. These soils are moderately slowly permeable or moderately permeable. They formed in calcareous glaciolacustrine sediments. Slope ranges from 0 to 3 percent.

Sanilac soils are similar to Gagetown soils and are commonly adjacent to Bach and Shebeon soils on the landscape. Gagetown soils have a mollic epipedon, are moderately well drained, and are above the Sanilac soils. Bach soils have a mollic epipedon, are poorly drained and very poorly drained, and are below the Sanilac soils. Shebeon soils have an argillic horizon, are fine-loamy, and are in topographic positions similar to those of the Sanilac soils.

Typical pedon of Sanilac silt loam, 0 to 3 percent slopes, 258 feet north and 1,980 feet east of the southwest corner of section 23, T. 15 N., R. 10 E.

Ap—0 to 13 inches; dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable; common roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

B21—13 to 18 inches; pale brown (10YR 6/3) very fine sandy loam; faces of peds are grayish brown (10YR 5/2); common fine faint light brownish gray (10YR 6/2) and common medium prominent yellowish brown (10YR 5/6) mottles; weak thin platy structure; friable; slight effervescence; moderately alkaline; abrupt wavy boundary.

B22—18 to 25 inches; brown (10YR 5/3) very fine sandy loam; common medium prominent yellowish brown (10YR 5/6) and common medium faint light brownish gray (10YR 6/2) mottles; medium thin platy structure; friable; strong effervescence; moderately alkaline.

C1—25 to 32 inches; pale brown (10YR 6/3) stratified very fine sandy loam and loamy very fine sand; few fine faint light brownish gray (10YR 6/2) and few fine prominent yellowish brown (10YR 5/6) mottles; weak thin platy structure; friable; strong effervescence; moderately alkaline; abrupt wavy boundary.

C2—32 to 60 inches; pale brown (10YR 6/3) loamy very fine sand; common medium prominent yellowish brown (10YR 5/6) and few fine light brownish gray (10YR 6/2) mottles; massive; friable; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 18 to 40 inches. Depth to free carbonates is 10 inches or less.

The Ap horizon has color value of 3 or 4 and chroma of 1 through 3. It ranges in thickness from 8 to 12 inches. It is silt loam, but the range includes fine sandy loam or loam. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 6; and chroma of 2 or 3. It is typically very fine sandy loam, but it is very fine sand, loamy very fine sand, fine sandy loam, or silt loam in some pedons. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 2 or 3. The upper part of the C horizon has strata of loamy fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam, and silt loam. The lower part has, in addition, strata of fine gravel, sand, and silty clay loam.

Shebeon series

The Shebeon series consists of deep, somewhat poorly drained soils on glacial till plains. These soils are moderately or moderately slowly permeable in the upper part and very slowly permeable in the lower part. They formed in loamy calcareous till. Slope ranges from 0 to 4 percent.

Shebeon soils are similar to Londo soils and are commonly adjacent to Badaxe, Grindstone, and Kilmanagh soils on the landscape. Londo soils do not have a very slowly permeable C horizon. Badaxe soils are coarse-loamy and are in topographic positions similar to those of the Shebeon soils. Grindstone soils are moderately well drained and are above the Shebeon soils. Kilmanagh soils have no argillic horizon, are poorly drained, and are below the Shebeon soils.

Typical pedon of Shebeon loam, 0 to 2 percent slopes, 2,160 feet south and 510 feet west of the northeast corner of section 21, T. 17 N., R. 10 E.

Ap—0 to 11 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; few roots; about 1 percent pebbles and cobbles; neutral; abrupt smooth boundary.

B21—11 to 17 inches; yellowish brown (10YR 5/4) clay loam; few fine prominent gray (10YR 5/1) and yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; few roots; grayish brown (10YR 5/2) clay films on faces of peds; about 3 percent pebbles and cobbles; mildly alkaline; gradual wavy boundary.

B22tg—17 to 23 inches; grayish brown (10YR 5/2) clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; brown (10YR 4/3) clay films on faces of peds; about 3 percent pebbles and cobbles; mildly alkaline; abrupt wavy boundary.

C1g—23 to 33 inches; grayish brown (10YR 5/2) loam; common medium prominent yellowish brown (10YR 5/6) and few fine distinct brown (7.5YR 5/4) mottles; weak medium platy structure; firm; about 3 percent pebbles and 2 percent cobbles; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—33 to 49 inches; yellowish brown (10YR 5/4) loam; faces of peds are gray (10YR 6/1); common fine distinct yellowish brown (10YR 5/6) mottles; moderate thick platy structure; very firm; about 3 percent pebbles and 2 percent cobbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—49 to 60 inches; yellowish brown (10YR 5/4) loam; horizontal and some vertical faces of peds are dark reddish brown (5YR 3/2), light brownish gray (10YR 6/2) coatings on other vertical and oblique faces of peds and fracture planes; few fine prominent yellowish brown (10YR 5/8) mottles; strong thick platy structure; very firm; about 3 percent pebbles and 2 percent cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates are typically about 20 inches and range from 11 to 26 inches. Depth to a horizon with very firm consistence ranges from 24 to 40 inches. Pebble and cobble content ranges from 2 to 35 percent in the A horizon and from 2 to 18 percent in the rest of the pedon. Reaction of the solum ranges from neutral to mildly alkaline.

The Ap horizon has color value of 3 or 4 and chroma of 2 or 3. It ranges in thickness from 6 to 12 inches. It is dominantly sandy loam, cobbly loam, or loam, but the range includes loamy sand and cobbly sandy loam. Some pedons have a B1 horizon. The B2 horizon has value of 3 to 5 and chroma of 2 to 4. It is loam or clay loam.

Tappan series

The Tappan series consists of deep, poorly drained soils on glacial till plains. These soils are moderately permeable or moderately slowly permeable in the upper part and slowly permeable in the lower part. They formed in loamy calcareous till. Slope is 0 to 1 percent.

Tappan soils are similar to Bach soils and are commonly adjacent to Bach, Kilmanagh, and Shebeon soils on the landscape. Bach soils are coarse-silty. Kilmanagh soils have no free carbonates within 10 inches of the surface. Bach and Kilmanagh soils are in topographic positions similar to those of the Tappan soils. Shebeon soils have an argillic horizon, are somewhat poorly drained, and are above the Tappan soils.

Typical pedon of Tappan loam, 152 feet south and 2,340 feet west of the northeast corner of section 19, T. 15 N., R. 10 E.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; few roots; about 1 percent pebbles; slight effervescence; moderately alkaline; abrupt smooth boundary.

A12—11 to 13 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; few roots; about 2 percent pebbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

B11g—13 to 15 inches; light brownish gray (10YR 6/2) and gray (10YR 5/1) loam; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; about 5 percent pebbles and cobbles; slight effervescence; moderately alkaline; clear wavy boundary.

B12g—15 to 21 inches; grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine angular blocky structure; friable; about 6 percent pebbles and cobbles; strong effervescence; moderately alkaline; clear wavy boundary.

B2g—21 to 31 inches; gray (10YR 5/1) loam; common medium prominent yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 5/6) mottles; moderate thick platy structure parting to moderate fine angular blocky; firm; about 4 percent pebbles and cobbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—31 to 48 inches; yellowish brown (10YR 5/4) loam, common medium prominent gray (10YR 5/1) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; firm; about 4 percent pebbles and cobbles; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—48 to 60 inches; yellowish brown (10YR 5/4) loam; few fine distinct yellowish brown (10YR 5/6) and few medium prominent light gray (10YR 6/1) mottles; weak thick platy structure; firm; about 4 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 20 to 36 inches. Depth to free carbonates is 10 inches or less.

The A horizon has color value of 2 or 3 and chroma of 1 or 2. It ranges in thickness from 10 to 14 inches. It is dominantly loam, but the range includes loamy sand or sandy loam. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is loam or clay loam. The C horizon has hue of 10YR or 2.5Y; value of 4 to 6; and chroma of 1 to 4.

Tobico series

The Tobico series consists of deep, poorly drained and very poorly drained soils on glacial outwash plains. These soils are rapidly permeable. They formed in sandy calcareous glaciofluvial sediments. Slope is 0 to 1 percent.

Tobico soils are commonly adjacent to Boyer and Granby soils on the landscape. Boyer soils have an argillic horizon, are well drained, and are above the Tobico soils. Granby soils have a mollic epipedon and are in topographic positions similar to those of the Tobico soils.

Typical pedon of Tobico mucky sandy loam, 630 feet east and 700 feet north of the southwest corner of section 28, T. 17 N., R. 13 E.

A11—0 to 5 inches; black (5Y 2/1) mucky sandy loam, same color dry; weak medium subangular blocky structure; friable; many roots; about 5 percent pebbles and cobbles; mildly alkaline; clear wavy boundary.

A12—5 to 8 inches; very dark gray (10YR 3/1) mucky sandy loam, gray (10YR 4/1) dry; moderate medium angular blocky structure; friable; common roots; about 5 percent pebbles and cobbles; mildly alkaline; clear wavy boundary.

B21g—8 to 10 inches; gray (10YR 5/1) sandy loam; weak medium subangular blocky structure; friable; few roots; about 5 percent pebbles and cobbles; slight effervescence; moderately alkaline; clear wavy boundary.

B22g—10 to 19 inches; grayish brown (10YR 5/2) loamy sand; few medium prominent yellowish brown (10YR 5/6) mottles; very weak fine subangular blocky structure; very friable; few roots; about 5 percent pebbles and cobbles; slight effervescence; moderately alkaline; gradual wavy boundary.

B23g—19 to 25 inches; grayish brown (10YR 5/2) sand; many coarse prominent yellowish brown (10YR 5/6) mottles; single grained; loose; few roots; about 5 percent pebbles and cobbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

IIC1—25 to 35 inches; brown (10YR 5/3) gravelly sand; common medium faint grayish brown (10YR 5/2) and many coarse prominent yellowish brown (10YR 5/6) mottles; single grained; loose; about 20 percent pebbles and cobbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

IIC2g—35 to 60 inches; dark gray (10YR 4/1) sand; single grained; loose; about 10 percent pebbles and cobbles; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 15 to 30 inches. Depth to free carbonates is 15 inches or less.

The thickness of the A1 horizon ranges from 5 to 9 inches. It is dominantly muck and sandy loam, but the range includes sand, mucky sand, loamy sand, or muck. The B2 horizon has hue of 10YR, 2.5Y, or 5Y and value of 4 or 5. It is sand, fine sand, loamy sand, or sandy loam. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 to 3. It is gravelly sand, sand, or fine sand.

Tyre series

The Tyre series consists of moderately deep, somewhat poorly drained soils on glacial till plains. These soils are rapidly permeable. They formed in material weathered from sandstone or in noncalcareous till over sandstone bedrock. Slope ranges from 0 to 2 percent.

Tyre soils are similar to Deerton Variant soils and are commonly adjacent to them on the landscape. Deerton Variant soils have a spodic horizon, are well drained and moderately well drained, and are above the Tyre soils.

Typical pedon of Tyre loamy sand, 0 to 2 percent slopes, 2,145 feet west and 1,100 feet north of the southeast corner of section 11, T. 18 N., R. 13 E.

A1—0 to 2 inches; black (N 2/0) loamy sand; very weak very fine subangular blocky structure; very friable; many roots; about 10 percent cobbles; strongly acid; abrupt wavy boundary.

B2g—2 to 5 inches; dark grayish brown (10YR 4/2) loamy sand; very weak very fine subangular blocky structure; very friable; common roots; about 10 percent cobbles; medium acid; clear wavy boundary.

C1g—5 to 12 inches; light gray (10YR 7/2) sand; weak coarse subangular blocky structure; very friable; few roots; about 10 percent cobbles; slightly acid; clear wavy boundary.

C2—12 to 18 inches; pale olive (5Y 6/3) loamy sand; common medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very friable; few roots; about 5 percent cobbles; neutral; clear broken boundary.

C3g—18 to 25 inches; light gray (2.5Y 7/2) cobbly sand; strong brown (7.5YR 5/6) bands; single grained; loose; about 30 percent cobbles; neutral; diffuse wavy boundary.

Cr—25 to 32 inches; light gray (2.5Y 7/2) weathered sandstone; strong brown (7.5YR 5/6) bands; massive; friable; neutral; diffuse wavy boundary.

R—32 inches; sandstone bedrock.

Thickness of the solum ranges from 5 to 18 inches. Depth to unweathered sandstone bedrock ranges from 20 to 40 inches. Reaction ranges from strongly acid to neutral.

The A1 horizon has hue of 10YR or is neutral and it has chroma of 0 to 2. It ranges in thickness from 1 to 4 inches. It is dominantly loamy sand, but the range includes sand. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 7; and chroma of 1 or 2. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 7; and chroma of 2 or 3.

Wasepi series

The Wasepi series consists of deep, somewhat poorly drained soils on glacial outwash plains, valley trains, and deltas. These soils are moderately rapidly permeable in the upper part and moderately slowly permeable in the lower part. They formed in sandy, calcareous glaciofluvial sediments. Slope ranges from 0 to 2 percent.

Wasepi soils are similar to Riverdale soil and are commonly adjacent to Pipestone and Shebeon soils on the landscape. Riverdale soils have an argillic horizon at a depth of more than 20 inches. Pipestone soils have a spodic horizon. Shebeon soils are fine-loamy. Pipestone and Shebeon soils are in topographic positions similar to those of the Wasepi soils.

Typical pedon of Wasepi loamy sand, loamy substratum, 0 to 2 percent slopes, 150 feet east and 50 feet south of the northwest corner of section 36, T. 16 N., R. 12 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loamy sand, dark grayish brown (10YR 4/2) dry; weak medium granular structure; very friable; many roots; about 1 percent pebbles; mildly alkaline; abrupt smooth boundary.

A2—9 to 13 inches; light brownish gray (10YR 6/2) loamy sand; very weak fine subangular blocky structure; very friable; few roots; about 1 percent pebbles; mildly alkaline; clear wavy boundary.

B1—13 to 18 inches; dark yellowish brown (10YR 4/4) loamy sand; many fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; very friable; few roots; about 2 percent pebbles; mildly alkaline; clear wavy boundary.

B2t—18 to 26 inches; yellowish brown (10YR 5/4) gravelly sandy loam; many coarse distinct grayish brown (10YR 5/2) and many coarse distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; about 20 percent pebbles and cobbles; mildly alkaline, clear wavy boundary.

IIC1—26 to 45 inches; grayish brown (10YR 5/2) stratified sand and gravel; single grained; loose; about 30 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

IIIC2g—45 to 60 inches; grayish brown (10YR 5/2) loam; many fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure;

firm; about 5 percent pebbles and cobbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 20 to 40 inches. Depth to the loamy substratum ranges from 40 to 60 inches. Pebble content, by volume, ranges from 1 to 20 percent in the solum and from 2 to 30 percent in the IIC horizon. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has color value of 2 or 3 and chroma of 1 through 3. It ranges in thickness from 6 to 10 inches. It is dominantly loamy sand, but the range includes sandy loam. The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is gravelly sandy loam or sandy loam. The IIC horizon has value of 5 or 6 and chroma of 2 to 6. The IIC horizon is typically loam but is sandy loam or clay loam in some pedons.

Formation of the soils

This section first describes the five major soil-forming factors and explains how they interact to form soils from the unconsolidated parent material. The processes of soil formation are then explained under "Genesis and morphology." And finally, a table gives the percentage composition of 16 selected map units as determined by the point-intercept transect method.

Factors of soil formation

Soil forms through the interaction of five major factors: the physical, chemical, and mineral 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, including the depth to the water table; and the length of time the processes of soil formation have acted on the parent material.

Climate and plant and animal life are the active forces 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 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 soils 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 from which a soil forms. The parent materials of the soils of Huron County were deposited by glaciers or by melt water from the glaciers. Some of these materials were reworked and redeposited by subsequent actions of water and wind. These glaciers covered the county from 10,000 to 12,000 years ago. Parent material determines the limits of the chemical and mineralogical composition of the soil. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Huron County were deposited as glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material. Slightly more than 5,000 acres developed in glacial till and outwash deposits over limestone and sandstone bedrock.

Glacial till is material laid down directly by glaciers with a minimum of water action. It consists of particles of different sizes that are mixed together. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Huron County is calcareous. Its texture is sandy loam, loam, or clay loam. Shebeon soils, for example, formed in glacial till. They typically are medium textured and have well developed structure.

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 similar size, such as loamy sand, sand, gravel, and other coarse particles. The Boyer soils, for example, formed in deposits of outwash material in Huron County.

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. In Huron County, soils formed in lacustrine deposits are typically medium textured. Bach soils for example, formed in lacustrine material.

Alluvium is deposited by floodwaters of streams in recent time. This material ranges in texture, depending on the speed of the water from which it was deposited. Examples of alluvial soils are the Fluvaquents.

Organic material is made up of deposits of plant remains. After the glaciers withdrew from the area, water was left standing in depressions of outwash plains, flood plains, moraines, and till plains. Grasses and sedges growing around the edges of these lakes died, and the remains did not decompose but remained around the edge of the lake. Later, water-tolerant trees grew in the areas. As these trees died, their residue became a part of the organic accumulation. Consequently, the lakes were eventually filed with organic material and developed into areas of muck. Pinnebog soils formed in organic material.

Plant and animal life

Green plants are the principal organisms influencing the soils in Huron County, but 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 kinds of plants that it supported. 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 native vegetation in Huron County was mainly deciduous forest. Differences in natural soil drainage and in parent material affected the composition of the forest species.

In general, the well drained and moderately well drained upland soils, such as the Guelph, Grindstone, and Boyer soils, were mainly covered with sugar maple. The Plainfield soils were covered with scrub oak and red pine. The wet soils were covered mainly by red maple, elm, and ash. The Corunna and Parkhill soils formed under wet conditions and contain considerable organic matter.

Climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil, and it determines the amount of water available for weathering minerals and transporting soil material. Climate, through its influence on temperatures in the soil, determines the rate of chemical reaction that occurs in the soil. These influences are important, but affect large areas rather than a relatively small area, such as a county.

The climate in Huron County is cool and humid. This is presumably similar to that which existed when the soils formed. The soils in Huron County 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 proximity to Saginaw Bay and Lake Huron. Only minor differences in the soils of Huron County are the results of the differences in climate.

Relief

Relief, or topography, has a marked influence on the soils of Huron County through its influence on natural drainage, erosion, plant cover, and soil temperature. In Huron County slopes range from 0 to 18 percent. Natural soil drainage ranges from excessively drained on the sandy ridgetops to very poorly drained in the 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 slopes. In low areas, water is temporarily ponded. Water and air move freely through soils that are well drained but slowly through soils that are very poorly drained. In soils that are well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized, and in poorly aerated soils the color is dull gray and mottled. Plainfield soils are examples of excessively drained, well aerated soils. Tobico soils are examples of poorly aerated, poorly drained and very poorly drained soils. They formed in similar parent material.

Time

Time, usually a long time, is required by the agents of soil formation to develop distinct horizons from parent material. The differences in length of time that the parent materials have been in place are commonly reflected in the degree of development of the soil profile. Some soils develop rapidly, others slowly.

The soils in Huron County range from young to mature. The glacial deposits from which many of the soils in Huron County formed have been exposed to soil-forming factors for a long enough time to allow distinct horizons to develop. Some soils forming in recent alluvial sediments have not been in place long enough for distinct horizons to develop.

The Fluvaquents are examples of young soils that formed in alluvial material. The Kilmanagh series shows the effect of more time on leaching of lime from the soil.

Genesis and morphology

The processes, or soil-forming factors, responsible for the development of the soil horizons from the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the various soil horizons are termed soil morphology.

Several processes were involved in the development of soil horizons in the soils of Huron County; (1) accumulation of organic matter, (2) leaching of lime (calcium carbonate) and other bases, (3) reduction and transfer of iron, and (4) formation and translocation of silicate clay minerals. In most soils of Huron County more than one of these processes have been active in the development of the horizon.

Organic matter accumulated 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 mineral soils of

Huron County, the surface layer ranges from high to low in organic matter content. Tobico soils, for example, have a high organic matter content in the surface layer, and the Plainfield soils have a low organic matter content.

Leaching of carbonates and other bases occurred in most of the soils. Soil scientists generally agree that leaching of bases in soils usually preceeds the translocation of silicate clay minerals. Many of the soils of Huron County are slightly to moderately leached. For example, Kilmanagh soils are leached of carbonates to a depth of about 29 inches, whereas Tappan soils still have some carbonates at the surface. Differences in the depth of leaching result from differences in carbonate content of the parent material.

The 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 indicates the reduction and loss of iron. Tappan soils are an example of gleying and the reduction processes.

Translocation of clay minerals has contributed to horizon development in many medium textured soils. The eluviated, or leached, A2 horizon above an illuviated B horizon is lower in content of clay and is lighter in color than the B horizon. The B horizon typically has an accumulation of clay (clay films) in pores and on ped surfaces. These soils were probably leached of carbonates and soluble salts to a considerable extent before translocation of silicate clay took place. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation. The Guelph soil is an example of a soil in which translocated silicate clays in the form of clay films accumulated in the B horizon.

In some sandy soils iron, aluminum, and humus have moved from the surface and subsurface layers to the B horizon. The color of the B horizon in such soils is dark brown or strong brown. Avoca, Covert, and Pipestone soils are examples of soils in which translocated iron, aluminum, and humus have accumulated in the B horizon.

Average composition of selected map units

Table 19 presents the results of a special study made during the survey to determine the composition of 16 selected map units by the point-intercept transect method. These units make up about 80 percent of the county. Because of the scale of mapping and the characteristic variation of soils, most map units consist of more than one taxonomic unit. The map unit is named for the taxon of the dominant soil or soils. The taxa of other soils in the map unit are considered inclusions.

The information from notes and observations made in the field was used along with the data from this study to determine the composition of the 16 selected map units. These 16 map units are described in the section "Soil maps for detailed planning."

The procedure used was the point-intercept transect method (*3*). Briefly the procedure was first to select representative areas of each selected map unit. Next, identify the taxonomic unit at 60-pace intervals along a line that transects these areas, crossing at least from the edge of an area to the center. Such transects were distributed throughout the areas of each map unit. Not more than 10 points were observed on any one transect.

The percent composition of 16 selected map units is given in table 19. Those taxonomic units (soil series) identified on the transects of the selected map units are divided into three catagories: named series and similar series, somewhat contrasting series, and strongly contrasting series. The categories are based on the placement of the series in the Michigan soil management group interpretive system (*5*). The series listed in the named series and similar series column are in the same soil management group; those in the somewhat contrasting series column are in closely related soil management groups. The series listed in the strongly contrasting series column are different in use and management from those in named and similar series of the map unit. Each series listed in the table is described in the section "Soil series and morphology."

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Linsemier, Lyle H. 1968. Use of the point-intercept transect in Michigan soil surveys. 99 pp. (Unpublished master's thesis submitted Mich. State Univ.)

(4) Michigan State University. 1970. Fertilizer recommendations for vegetables and field crops in Michigan. Ext. Bull. E-550, 24 pp.

(5) Mokma, D. L., E. P. Whiteside, and I. F. Schneider. 1975. Soil management units and land use planning. Bull. 254. Mich. State Univ. 12 pp.

(6) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 53 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(7) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(8) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for

making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock. Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Light textured soil. Sand and loamy sand.

Linear. Long and uniform in width.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Temperature: Average number of growing degree days[1]	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
Bad Axe:[2]											
January---	29.1	14.3	21.7	53	-13	0	1.86	1.1	2.6	6	12.2
February--	31.2	14.3	22.7	51	-13	0	1.87	.8	2.8	5	12.6
March-----	39.5	22.2	30.9	68	-4	5	2.30	1.3	3.2	6	9.7
April-----	55.0	33.8	44.4	82	15	58	2.66	1.8	3.4	7	2.6
May-------	67.0	43.0	55.0	86	25	211	2.60	1.5	3.6	7	.1
June------	77.4	53.5	65.4	93	35	471	2.86	1.7	3.9	7	0
July------	81.5	57.5	69.5	94	41	613	3.01	2.0	4.0	6	0
August----	80.2	56.4	68.3	94	39	576	2.66	1.0	4.0	5	0
September-	72.3	49.9	61.1	91	31	349	2.48	1.6	3.2	6	T
October---	62.0	41.3	51.7	84	22	146	2.39	1.2	3.4	5	.9
November--	45.8	31.0	38.4	69	8	14	2.39	1.4	3.2	6	6.4
December--	33.4	20.3	26.9	59	-3	0	2.09	1.1	3.0	6	11.5
Year-----	56.2	36.5	46.3	96	-15	2,443	29.17	25.2	33.0	71	56.1
Harbor Beach:[3]											
January---	28.7	15.3	22.0	51	-11	0	2.66	1.8	3.4	8	20.5
February--	30.5	15.8	23.2	49	-9	0	2.31	1.5	3.1	8	18.2
March-----	37.7	23.2	30.5	66	-1	3	2.47	1.5	3.3	7	13.1
April-----	52.0	34.1	43.0	81	18	43	2.84	1.9	3.7	7	3.7
May-------	63.0	42.7	52.8	87	29	161	2.63	1.6	3.6	7	.4
June------	73.9	53.2	63.5	93	37	416	3.18	1.8	4.4	7	0
July------	78.2	58.7	68.5	93	44	580	3.22	2.1	4.3	6	0
August----	77.3	58.4	67.9	94	44	560	3.16	1.5	4.6	6	0
September-	70.3	51.9	61.1	91	35	345	2.75	1.9	3.5	7	T
October---	60.2	42.8	51.5	83	24	134	2.66	1.3	3.8	6	1.1
November--	45.4	32.2	38.8	70	11	14	2.89	2.3	3.5	8	7.5
December--	33.3	21.3	27.3	59	-2	0	3.17	2.1	4.1	10	19.8
Year-----	54.2	37.5	45.8	96	-13	2,256	33.94	29.9	37.9	87	84.3

[1]A growing degree day is an index of the amount of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

[2]Data recorded in the period 1947-76 at Bad Axe.

[3]Data recorded in the period 1948-76 at Harbor Beach.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Minimum temperature[1]					
	24° F or lower		28° F or lower		32° F or lower	
	Bad Axe	Harbor Beach	Bad Axe	Harbor Beach	Bad Axe	Harbor Beach
Last freezing temperature in spring:						
1 year in 10 later than--	5-03	4-24	5-20	5-08	5-29	5-23
2 years in 10 later than--	4-28	4-20	5-14	5-03	5-24	5-23
5 years in 10 later than--	4-17	4-10	5-02	4-25	5-15	5-09
First freezing temperature in fall:						
1 year in 10 earlier than--	10-16	10-23	9-30	10-09	9-18	10-02
2 years in 10 earlier than--	10-23	10-31	10-06	10-16	9-24	10-06
5 years in 10 earlier than--	11-05	11-13	10-18	10-28	10-06	10-15

[1]Recorded during the period 1930-1974.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season[1]					
	Higher than 24° F		Higher than 28° F		Higher than 32° F	
	Bad Axe	Harbor Beach	Bad Axe	Harbor Beach	Bad Axe	Harbor Beach
9 years in 10	176	192	143	164	120	139
8 years in 10	185	200	152	171	128	146
5 years in 10	202	216	169	185	144	159
2 years in 10	219	232	186	199	159	172
1 year in 10	228	241	195	206	167	179

[1]Recorded during the period 1930-1974.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
3A	Shebeon loam, 0 to 2 percent slopes	125,520	23.7
4B	Grindstone loam, 0 to 4 percent slopes	10,380	2.0
5	Kilmanagh loam	100,530	19.0
6A	Avoca loamy sand, 0 to 2 percent slopes	39,845	7.5
7A	Aubarque loam, 0 to 2 percent slopes	15,135	2.9
7B	Aubarque loam, 2 to 6 percent slopes	1,240	0.2
9B	Plainfield sand, 0 to 6 percent slopes	650	0.1
9C	Plainfield sand, 6 to 12 percent slopes	410	0.1
11A	Covert sand, loamy substratum, 0 to 2 percent slopes	3,395	0.6
12A	Sanilac silt loam, 0 to 3 percent slopes	10,275	1.9
13B	Gagetown silt loam, 0 to 4 percent slopes	1,060	0.2
14A	Badaxe fine sandy loam, 0 to 3 percent slopes	6,860	1.3
15B	Deerton Variant gravelly loamy sand, 0 to 4 percent slopes	1,210	0.2
18	Tappan loam	20,525	3.9
19	Corunna sandy loam	7,025	1.3
20A	Covert sand, 0 to 2 percent slopes	4,390	0.8
23	Fluvaquents, loamy	10,385	2.0
24	Aquents and Histosols, ponded	4,965	0.9
26B	Boyer loamy sand, 0 to 6 percent slopes	3,815	0.7
26C	Boyer loamy sand, 6 to 12 percent slopes	310	0.1
27	Filion stony loam	3,655	0.7
28B	Covert-Tobico complex, 0 to 6 percent slopes	6,605	1.2
29A	Pipestone-Tobico-Adrian complex, 0 to 2 percent slopes	2,530	0.5
30	Bach silt loam	7,995	1.5
31	Belleville loamy sand	7,010	1.3
32C	Plainfield-Covert sands, 2 to 12 percent slopes	5,355	1.0
34	Aurelius muck	2,100	0.4
36A	Pipestone sand, 0 to 2 percent slopes	7,625	1.4
38A	Mitiwanga cobbly sandy loam, 0 to 3 percent slopes	3,765	0.7
39A	Rapson loamy sand, 0 to 2 percent slopes	2,715	0.5
40A	Wasepi loamy sand, loamy substratum, 0 to 2 percent slopes	3,460	0.7
42A	Tyre loamy sand, 0 to 2 percent slopes	240	0.1
43	Tobico mucky sandy loam	4,100	0.8
44A	Badaxe cobbly sandy loam, 0 to 3 percent slopes	1,670	0.3
45	Granby loamy sand	1,315	0.2
46	Linwood muck	6,945	1.3
49B	Grindstone-Kilmanagh loams, 0 to 4 percent slopes	11,750	2.3
50A	Shebeon-Badaxe sandy loams, 0 to 2 percent slopes	12,805	2.5
51B	Guelph-Londo loams, 2 to 6 percent slopes	19,115	3.6
51C	Guelph loam, 6 to 12 percent slopes	5,775	1.1
51D	Guelph loam, 12 to 18 percent slopes	960	0.2
53B	Shebeon cobbly loam, 0 to 4 percent slopes	10,820	2.1
54B	Grindstone cobbly loam, 0 to 4 percent slopes	1,240	0.2
55	Kilmanagh cobbly loam	5,455	1.0
56A	Riverdale-Pipestone complex, 0 to 2 percent slopes	5,760	1.1
57A	Londo loam, 0 to 2 percent slopes	6,755	1.3
58	Parkhill loam	8,070	1.5
60	Pinnebog muck	1,760	0.3
62	Essexville loamy sand	1,210	0.2
63	Pits	1,855	0.3
64	Udipsamments, nearly level	1,115	0.2
	Water	560	0.1
	Total	530,015	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Corn silage	Winter wheat	Oats	Sugar beets	Other dry beans	Grass-legume hay
	Bu	Ton	Bu	Bu	Ton	Bu	Ton
3A------------------------ Shebeon	120	18	60	100	20	35	4.5
4B------------------------ Grindstone	110	17	55	90	19	30	4.3
5------------------------- Kilmanagh	130	20	60	110	23	35	4.9
6A------------------------ Avoca	100	16	45	80	16	15	4.2
7A------------------------ Aubarque	110	17	60	85	18	30	4.5
7B------------------------ Aubarque	100	16	50	80	17	25	4.5
9B, 9C-------------------- Plainfield	50	10	25	45	---	---	2.7
11A----------------------- Covert	55	11	28	50	---	13	3.0
12A----------------------- Sanilac	120	18	60	95	20	30	4.5
13B----------------------- Gagetown	110	17	60	90	19	33	4.5
14A----------------------- Badaxe	110	17	55	95	18	20	4.5
15B----------------------- Deerton Variant	50	10	25	40	---	13	2.5
18------------------------ Tappan	130	20	65	110	23	35	4.8
19------------------------ Corunna	120	18	65	100	22	30	4.5
20A----------------------- Covert	50	10	20	40	---	---	2.7
23*. Fluvaquents							
24------------------------ Aquents and Histosols	---	---	---	---	---	---	---
26B----------------------- Boyer	70	12	30	50	---	13	3.1
26C----------------------- Boyer	65	11	28	45	---	---	2.6
27------------------------ Filion	---	---	---	---	---	---	---
28B----------------------- Covert-Tobico	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Winter wheat	Oats	Sugar beets	Other dry beans	Grass-legume hay
	Bu	Ton	Bu	Bu	Ton	Bu	Ton
29A----------------------- Pipestone-Tobico-Adrian	---	---	---	---	---	---	---
30----------------------- Bach	130	20	65	110	23	35	4.9
31----------------------- Belleville	105	17	50	85	18	20	4.1
32C----------------------- Plainfield-Covert	---	---	---	---	---	---	---
34----------------------- Aurelius	---	---	---	---	---	---	---
36A----------------------- Pipestone	60	12	30	60	---	---	3.0
38A----------------------- Mitiwanga	90	15	40	80	16	18	4.0
39A----------------------- Rapson	100	16	45	80	15	---	3.8
40A----------------------- Wasepi	80	13	35	65	---	14	3.4
42A----------------------- Tyre	---	---	---	---	---	---	---
43----------------------- Tobico	80	13	40	60	---	16	3.4
44A----------------------- Badaxe	90	15	40	80	16	18	4.2
45----------------------- Granby	80	13	40	60	---	16	3.4
46----------------------- Linwood	---	---	---	---	---	---	---
49B----------------------- Grindstone-Kilmanagh	116	18	56	96	20	28	4.4
50A----------------------- Shebeon-Badaxe	112	17	56	96	19	25	4.8
51B----------------------- Guelph-Londo	110	17	60	90	19	25	4.8
51C----------------------- Guelph	90	16	45	85	---	---	4.5
51D----------------------- Guelph	---	---	35	70	---	---	4.0
53B----------------------- Shebeon	100	16	55	90	18	30	4.1
54B----------------------- Grindstone	90	15	55	80	---	23	3.8
55----------------------- Kilmanagh	110	18	60	100	21	31	5.0
56A----------------------- Riverdale-Pipestone	69	13	31	60	---	---	3.3

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Winter wheat	Oats	Sugar beets	Other dry beans	Grass-legume hay
	Bu	Ton	Bu	Bu	Ton	Bu	Ton
57A----------------------- Londo	120	18	60	100	20	35	4.5
58------------------------ Parkhill	130	20	65	110	23	35	4.9
60------------------------ Pinnebog	---	---	---	---	---	---	---
62------------------------ Essexville	100	17	45	85	18	20	4.0
63*. Pits							
64*. Udipsamments							

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	369,945	20,175	338,150	11,620	---
III	93,360	7,325	82,220	3,815	---
IV	17,580	960	7,625	8,995	---
V	23,835	---	23,595	240	---
VI	6,415	---	---	6,415	---
VII	---	---	---	---	---
VIII	---	---	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
3A Shebeon	3o	Slight	Slight	Slight	Slight	White ash	56	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						Bitternut hickory	---	
						Green ash	56	
						American basswood	56	
						Red maple	56	
4B Grindstone	2o	Slight	Slight	Slight	Slight	Sugar maple	61	White spruce, eastern cottonwood.
						White ash	---	
						American basswood	---	
						Black cherry	---	
						American beech	---	
5 Kilmanagh	2w	Slight	Severe	Moderate	Moderate	Red maple	66	White spruce, green ash, black spruce.
						Swamp white oak	---	
						Green ash	---	
6A Avoca	3s	Slight	Slight	Moderate	Slight	Red maple	56	White spruce, black spruce, Austrian pine, eastern white pine.
						Eastern cottonwood	91	
						White ash	56	
						Black ash	---	
						Swamp white oak	---	
						Quaking aspen	70	
7A, 7B Aubarque	3d	Slight	Moderate	Moderate	Moderate	Red maple	56	Northern white-cedar, white spruce, eastern white pine, Austrian pine.
						Black ash	56	
						American basswood	56	
						White ash	56	
9B, 9C Plainfield	2s	Slight	Slight	Severe	Slight	Red pine	61	Red pine, eastern white pine, jack pine.
						Eastern white pine	---	
						Jack pine	---	
11A Covert	3s	Slight	Slight	Severe	Slight	Northern red oak	56	Red pine, eastern white pine, black walnut, eastern cottonwood.
						Red maple	56	
						Eastern cottonwood	91	
						White oak	---	
12A Sanilac	2o	Slight	Slight	Slight	Slight	Red maple	66	White spruce, eastern white pine, eastern cottonwood, Norway spruce, northern white-cedar, Austrian pine.
						White ash	66	
						American basswood	66	
13B Gagetown	2o	Slight	Slight	Slight	Slight	Northern red oak	66	Red pine, Norway spruce, white spruce, eastern white pine.
						American basswood	66	
						White ash	66	
						Sugar maple	61	
14A Badaxe	2o	Slight	Slight	Slight	Slight	White ash	66	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						Bitternut hickory	---	
						Green ash	66	
						American basswood	66	
						Red maple	66	
15B Deerton Variant	3s	Slight	Slight	Moderate	Slight	Sugar maple	53	Red pine, eastern white pine, jack pine.
						Northern red oak	---	
						Eastern white pine	53	
						Quaking aspen	60	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
18 Tappan	2w	Slight	Severe	Moderate	Moderate	Red maple White ash American basswood Quaking aspen	66 --- --- ---	White spruce, green ash, eastern cottonwood.
19 Corunna	3w	Slight	Severe	Moderate	Moderate	Red maple American sycamore Swamp white oak Green ash	56 --- --- ---	Eastern cottonwood, white ash, American sycamore, white ash, Norway spruce, Carolina poplar.
20A Covert	3s	Slight	Slight	Severe	Slight	Northern red oak Red maple Eastern cottonwood American basswood White oak	56 56 91 61 ---	Red pine, eastern cottonwood, eastern white pine, black walnut.
27 Filion	2w	Slight	Severe	Severe	Severe	Red maple Green ash Eastern cottonwood Northern white-cedar Swamp white oak Bur oak Quaking aspen	65 66 101 45 --- --- 70	Eastern cottonwood, white spruce, northern white-cedar.
28B*:								
Covert	3s	Slight	Slight	Severe	Slight	Northern red oak Red maple Eastern cottonwood White oak	56 56 91 ---	Red pine, eastern cottonwood, eastern white pine, black walnut.
Tobico	5w	Slight	Severe	Severe	Severe	Red maple Eastern cottonwood Swamp white oak Green ash	40 75 --- ---	Northern white-cedar.
29A*:								
Pipestone	3s	Slight	Slight	Severe	Slight	Red maple Eastern cottonwood Bitternut hickory	56 91 ---	White spruce, eastern cottonwood, eastern white pine, Norway spruce, Austrian pine.
Tobico	5w	Slight	Severe	Severe	Severe	Red maple Eastern cottonwood Swamp white oak Green ash	40 75 --- ---	
Adrian	3w	Slight	Severe	Severe	Severe	Red maple Quaking aspen Green ash	56 60 56	
30 Bach	2w	Slight	Severe	Severe	Severe	Red maple Black ash Swamp white oak Silver maple	66 --- 66 91	Northern white-cedar, eastern cottonwood, red maple.
31 Belleville	5w	Slight	Severe	Moderate	Moderate	Red maple Tamarack Swamp white oak Green ash	39 34 --- ---	Black spruce, white spruce.
32C*:								
Plainfield	2s	Slight	Slight	Severe	Slight	Red pine Eastern white pine Jack pine	61 --- ---	Red pine, eastern white pine, jack pine.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
32C*:								
Covert	3s	Slight	Slight	Severe	Slight	Northern red oak	56	Red pine, eastern cottonwood, eastern white pine, black walnut.
						Red maple	56	
						Eastern cottonwood	91	
						White oak	---	
34 Aurelius	3w	Slight	Severe	Severe	Severe	Red maple	55	
						Silver maple	---	
						Black ash	---	
						Swamp white oak	---	
36A Pipestone	3s	Slight	Slight	Severe	Slight	Red maple	56	White spruce, eastern cottonwood, eastern white pine, Norway spruce, Austrian pine.
						Eastern cottonwood	91	
						Bitternut hickory	---	
38A Mitiwanga	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Eastern white pine, yellow-poplar.
39A* Rapson	3s	Slight	Slight	Moderate	Slight	Red maple	56	Austrian pine, eastern white pine, white spruce, northern white-cedar, eastern cottonwood.
						Eastern cottonwood	91	
						Bitternut hickory	---	
						Swamp white oak	---	
						Quaking aspen	---	
						Paper birch	---	
40A Wasepi	3s	Slight	Slight	Moderate	Slight	Red maple	56	Eastern white pine, eastern cottonwood.
						Swamp white oak	---	
						Silver maple	82	
42A Tyre	3s	Slight	Slight	Moderate	Slight	Red maple	56	White spruce, black spruce, eastern white pine, Norway spruce.
						Northern red oak	56	
						Bitternut hickory	---	
						Sugar maple	---	
						Swamp white oak	---	
43 Tobico	5w	Slight	Severe	Severe	Severe	Red maple	40	
						Eastern cottonwood	75	
						Swamp white oak	---	
						Green ash	---	
44A Badaxe	2o	Slight	Slight	Slight	Slight	White ash	66	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						Bitternut hickory	---	
						Green ash	66	
						American basswood	66	
						Red maple	66	
45 Granby	5w	Slight	Severe	Severe	Severe	Red maple	40	Norway spruce, white spruce, European larch.
						Silver maple	60	
						American basswood	40	
						Quaking aspen	45	
						Eastern cottonwood	75	
						White ash	40	
46 Linwood	3w	Slight	Severe	Severe	Severe	Red maple	56	Northern white-cedar, black spruce, Carolina poplar.
						Silver maple	82	
						Swamp white oak	---	
49B*:								
Grindstone	2o	Slight	Slight	Slight	Slight	Sugar maple	61	White spruce, eastern cottonwood.
						White ash	---	
						American basswood	---	
						Black cherry	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
49B*:								
Kilmanagh----------	2w	Slight	Severe	Moderate	Moderate	Red maple-----------	66	White spruce, green ash, black spruce.
						Swamp white oak-----	---	
						Green ash-----------	---	
50A*:								
Shebeon------------	3o	Slight	Slight	Slight	Slight	White ash-----------	56	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						Bitternut hickory---	---	
						Green ash-----------	56	
						American basswood---	56	
						Red maple-----------	56	
Badaxe-------------	2o	Slight	Slight	Slight	Slight	White ash-----------	66	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						Bitternut hickory---	---	
						Green ash-----------	66	
						American basswood---	66	
						Red maple-----------	66	
51B*:								
Guelph-------------	2o	Slight	Slight	Slight	Slight	Sugar maple---------	61	White spruce, eastern white pine, black walnut, yellow-poplar.
						Northern red oak----	---	
						White oak-----------	---	
						Black cherry--------	---	
Londo--------------	2o	Slight	Slight	Slight	Slight	Green ash-----------	66	White spruce, eastern cottonwood, Norway spruce, black spruce, eastern white pine, red pine.
						Northern red oak----	66	
						Black oak-----------	---	
						Red maple-----------	66	
						American basswood---	66	
						Eastern cottonwood--	101	
						White ash-----------	65	
51C, 51D----------- Guelph	2o	Slight	Slight	Slight	Slight	Sugar maple---------	61	White spruce, eastern white pine, black walnut, yellow-poplar.
						Northern red oak----	---	
						White oak-----------	---	
						Black cherry--------	---	
53B---------------- Shebeon	3o	Slight	Slight	Slight	Slight	White ash-----------	56	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						Bitternut hickory---	---	
						Green ash-----------	56	
						American basswood---	56	
						Red maple-----------	56	
54B---------------- Grindstone	2o	Slight	Slight	Slight	Slight	Sugar maple---------	61	White spruce, eastern cottonwood.
						White ash-----------	---	
						American basswood---	---	
						Black cherry--------	---	
55----------------- Kilmanagh	2w	Slight	Severe	Moderate	Moderate	Red maple-----------	66	White spruce, green ash, black spruce.
						Swamp white oak-----	---	
						Green ash-----------	---	
56A*:								
Riverdale----------	3s	Slight	Slight	Moderate	Slight	Northern red oak----	56	White spruce, Norway spruce, eastern white pine, European larch.
						Red maple-----------	56	
						Eastern cottonwood--	91	
						American basswood---	56	
Pipestone----------	3s	Slight	Slight	Severe	Slight	Red maple-----------	56	White spruce, eastern cottonwood, eastern white pine, Norway spruce, Austrian pine.
						Eastern cottonwood--	91	
						Bitternut hickory---	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
57A: Londo	2o	Slight	Slight	Slight	Slight	Green ash	66	White spruce, eastern cottonwood, Norway spruce, black spruce, eastern white pine, red pine.
						Northern red oak	66	
						Black oak	---	
						Red maple	66	
						American basswood	66	
						Eastern cottonwood	101	
						White ash	65	
58: Parkhill	2w	Slight	Severe	Moderate	Moderate	Red maple	66	White spruce, green ash, eastern cottonwood, northern white-cedar, Carolina poplar.
						White ash	66	
						American basswood	66	
						Swamp white oak	---	
60: Pinnebog	3w	Slight	Severe	Severe	Severe	Red maple	55	
						Tamarack	40	
						Northern white-cedar	21	
						Black ash	---	
						Quaking aspen	50	
62: Essexville	5w	Slight	Severe	Severe	Severe	White ash	40	White spruce, paper birch, red maple, green ash, American sycamore, eastern cottonwood.
						Eastern cottonwood	75	
						Swamp white oak	---	
						Quaking aspen	40	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
3A----------------- Shebeon	---	Silky dogwood, American cranberrybush.	Northern white-cedar, eastern white pine, white spruce, Austrian pine.	Norway spruce-----	Green ash, European alder, Carolina poplar.
4B----------------- Grindstone	---	White spruce, autumn-olive, late lilac, silky dogwood.	Norway spruce, red pine, Austrian pine, American mountainash, eastern white pine.	---	Carolina poplar.
5------------------ Kilmanagh	---	Silky dogwood, Amur privet.	Northern white-cedar, eastern white pine.	Norway spruce-----	Green ash, Carolina poplar.
6A----------------- Avoca	---	Silky dogwood, American cranberrybush, Tatarian honeysuckle, late lilac.	White spruce, black spruce, northern white-cedar, Austrian pine, eastern white pine.	---	Carolina poplar, green ash.
7A, 7B------------- Aubarque	---	Amur privet, silky dogwood, Siberian crabapple.	Northern white-cedar, Austrian pine, Norway spruce.	---	Carolina poplar.
9B, 9C------------- Plainfield	Manyflower cotoneaster.	Lilac-------------	Norway spruce, Siberian peashrub.	Eastern white pine, red pine, jack pine.	---
11A---------------- Covert	Tatarian honeysuckle.	Autumn-olive, Amur privet.	White spruce, Austrian pine.	Scotch pine, eastern white pine, Norway spruce.	Carolina poplar.
12A---------------- Sanilac	---	Late lilac--------	White spruce, northern white-cedar, Austrian pine, Siberian crabapple.	Eastern white pine, red pine.	Carolina poplar.
13B---------------- Gagetown	Tatarian honeysuckle.	Blue spruce, Amur privet, autumn-olive, late lilac.	White spruce, red pine, eastern white pine.	Norway spruce-----	Carolina poplar.
14A---------------- Badaxe	---	Silky dogwood, American cranberrybush.	Northern white-cedar, eastern white pine, white spruce, Austrian pine.	Norway spruce-----	Green ash, European alder, Carolina poplar.
15B---------------- Deerton Variant	---	Tatarian honeysuckle, autumn-olive, lilac.	American mountainash.	Jack pine, eastern white pine, red pine.	---
18----------------- Tappan	---	Arrowwood, Amur privet, silky dogwood.	Northern white-cedar, eastern white pine.	Norway spruce-----	Green ash, Carolina poplar.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
19---------------- Corunna	American cranberrybush.	Austrian pine, white spruce, silky dogwood.	Green ash, eastern white pine, northern white-cedar, Norway spruce.	---	Carolina poplar.
20A--------------- Covert	Tatarian honeysuckle.	Autumn-olive, Amur privet.	White spruce, Austrian pine.	Scotch pine, eastern white pine, Norway spruce.	Carolina poplar.
23*. Fluvaquents					
24*: Aquents.					
Histosols.					
26B, 26C---------- Boyer	Silky dogwood-----	Autumn-olive, Vanhoutte spirea, Tatarian honeysuckle, Amur privet.	Red pine, tamarack.	Eastern white pine, jack pine, Scotch pine, white ash.	---
27---------------- Filion	---	Arrowwood, silky dogwood, hawthorn, Amur privet, whitebelle honeysuckle, Siberian crabapple.	Tamarack, northern white-cedar, eastern white pine, Norway spruce.	---	---
28B*: Covert-----------	Tatarian honeysuckle.	Autumn-olive, Amur privet.	White spruce, Austrian pine.	Scotch pine, eastern white pine, Norway spruce.	Carolina poplar.
Tobico-----------	---	Austrian pine, silky dogwood.	Northern white-cedar.	---	Carolina poplar.
29A*: Pipestone--------	---	American cranberrybush, Tatarian honeysuckle.	White spruce, Austrian pine, European larch, northern white-cedar.	---	Carolina poplar.
Tobico-----------	---	Austrian pine, silky dogwood.	Northern white-cedar.	---	Carolina poplar.
Adrian-----------	---	Silky dogwood, white spruce.	Austrian pine-----	Northern white-cedar, Carolina poplar, Scotch pine.	---
30---------------- Bach	---	Austrian pine, silky dogwood, whitebelle honeysuckle, late lilac.	Green ash, northern white-cedar, eastern white pine.	---	Carolina poplar.
31---------------- Belleville	---	Silky dogwood, Amur privet, Austrian pine.	Black spruce, northern white-cedar, eastern white pine, Norway spruce.	---	Carolina poplar.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
32C*:					
Plainfield	Manyflower cotoneaster.	Lilac	Norway spruce, Siberian peashrub.	Eastern white pine, red pine, jack pine.	---
Covert	Tatarian honeysuckle.	Autumn-olive, Amur privet.	White spruce, Austrian pine.	Scotch pine, eastern white pine, Norway spruce.	Carolina poplar.
34 Aurelius	Silky dogwood	Austrian pine, Amur privet, nannyberry viburnum, northern white-cedar.	---	---	Carolina poplar.
36A Pipestone	---	American cranberrybush, Tatarian honeysuckle.	White spruce, Austrian pine, European larch, northern white-cedar.	---	Carolina poplar.
38A Mitiwanga	---	Medium purple willow, gray dogwood, silky dogwood, American cranberrybush, redosier dogwood, hawthorn.	Northern white-cedar, Norway spruce.	European alder, pin oak, poplar, eastern white pine.	---
39A Rapson	---	Blue spruce, Tatarian honeysuckle, silky dogwood, American cranberrybush.	Austrian pine, eastern white pine, northern white-cedar.	Norway spruce, red pine.	---
40A Wasepi	---	Silky dogwood, Tatarian honeysuckle.	Eastern white pine, Scotch pine, northern white-cedar.	Red pine	Carolina poplar, European alder, green ash.
42A Tyre	---	Silky dogwood, American cranberrybush, Tatarian honeysuckle.	White spruce, black spruce, northern white-cedar, Austrian pine.	Norway spruce	---
43 Tobico	---	Austrian pine, silky dogwood.	Northern white-cedar.	---	Carolina poplar.
44A Badaxe	---	Silky dogwood, American cranberrybush.	Northern white-cedar, eastern white pine, white spruce, Austrian pine.	Norway spruce	Green ash, European alder, Carolina poplar.
45 Granby	---	Silky dogwood, Amur privet, white spruce, Austrian pine.	Eastern white pine, northern white-cedar, Norway spruce, tamarack.	---	---
46. Linwood					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
49B*:					
Grindstone	---	White spruce, autumn-olive, late lilac, silky dogwood.	Norway spruce, red pine, Austrian pine, American mountainash, eastern white pine.	---	Carolina poplar.
Kilmanagh	---	Silky dogwood, Amur privet.	Northern white-cedar, eastern white pine.	Norway spruce	Green ash, Carolina poplar.
50A*:					
Shebeon	---	Silky dogwood, American cranberrybush.	Northern white-cedar, eastern white pine, white spruce, Austrian pine.	Norway spruce	Green ash, European alder, Carolina poplar.
Badaxe	---	Silky dogwood, American cranberrybush.	Northern white-cedar, eastern white pine, white spruce, Austrian pine.	Norway spruce	Green ash, European alder, Carolina poplar.
51B*:					
Guelph	---	White spruce, Tatarian honeysuckle, autumn-olive, late lilac, Amur privet, Persian lilac, silky dogwood.	Eastern white pine, Norway spruce, Austrian pine.	Red pine	Carolina poplar.
Londo	---	Amur privet	White spruce, northern white-cedar, black spruce, blue spruce, European larch.	---	Carolina poplar, green ash.
51C, 51D Guelph	---	White spruce, Tatarian honeysuckle, autumn-olive, late lilac, Amur privet, Persian lilac, silky dogwood.	Eastern white pine, Norway spruce, Austrian pine.	Red pine	Carolina poplar.
53B Shebeon	---	Silky dogwood, American cranberrybush.	Northern white-cedar, eastern white pine, white spruce, Austrian pine.	Norway spruce	Green ash, European alder, Carolina poplar.
54B Grindstone	---	White spruce, autumn-olive, late lilac, silky dogwood.	Norway spruce, red pine, Austrian pine, American mountainash, eastern white pine.	---	Carolina poplar.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
55----------------- Kilmanagh	---	Silky dogwood, Amur privet.	Northern white-cedar, eastern white pine.	Norway spruce-----	Green ash, Carolina poplar.
56A*: Riverdale--------	---	Silky dogwood, Tatarian honeysuckle, American cranberrybush.	White spruce, eastern white pine, northern white-cedar, Austrian pine.	Norway spruce-----	---
Pipestone--------	---	American cranberrybush, Tatarian honeysuckle.	White spruce, Austrian pine, European larch, northern white-cedar.	---	Carolina poplar.
57A--------------- Londo	---	Amur privet-------	White spruce, northern white-cedar, black spruce, blue spruce, European larch.	---	Carolina poplar, green ash.
58---------------- Parkhill	---	Silky dogwood, Amur privet.	Northern white-cedar, eastern white pine, green ash.	Norway spruce-----	Carolina poplar.
60---------------- Pinnebog	---	Redosier dogwood, silky dogwood, Tatarian honeysuckle, white spruce.	Austrian pine, eastern white pine, tamarack.	Northern white-cedar, Norway spruce, Scotch pine.	---
62---------------- Essexville	---	Amur privet, hawthorn, silky dogwood.	Eastern white pine, tamarack, Norway spruce, northern white-cedar.	---	---
63*. Pits					
64*. Udipsamments					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
3A Shebeon	Severe: wetness, percs slowly, floods.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
4B Grindstone	Severe: percs slowly.	Moderate: wetness.	Severe: percs slowly.	Slight	Slight.
5 Kilmanagh	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
6A Avoca	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: too sandy, wetness.	Moderate: too sandy, wetness.
7A, 7B Aubarque	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness.
9B Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
9C Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: too sandy.
11A Covert	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
12A Sanilac	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
13B Gagetown	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Slight	Moderate: wetness.
14A Badaxe	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
15B Deerton Variant	Moderate: small stones, too sandy.	Moderate: too sandy.	Severe: small stones.	Moderate: too sandy.	Moderate: too sandy, small stones, thin layer.
18 Tappan	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
19 Corunna	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
20A Covert	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
23*. Fluvaquents					

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
24*:					
Aquents.					
Histosols.					
26B------------------- Boyer	Moderate: too sandy.	Moderate: too sandy.	Moderate: small stones, slope.	Moderate: too sandy.	Moderate: too sandy.
26C------------------- Boyer	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.	Moderate: too sandy, slope.
27-------------------- Filion	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: small stones, wetness, floods.	Severe: wetness.	Severe: wetness, floods, small stones.
28B*:					
Covert----------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Tobico----------------	Severe: floods, wetness, excess humus.	Severe: excess humus, wetness.	Severe: floods, excess humus, wetness.	Severe: excess humus, wetness.	Severe: wetness, floods.
29A*:					
Pipestone-------------	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Severe: wetness, too sandy.
Tobico----------------	Severe: floods, wetness, excess humus.	Severe: excess humus, wetness.	Severe: floods, excess humus, wetness.	Severe: excess humus, wetness.	Severe: wetness, floods.
Adrian----------------	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, floods, wetness.
30-------------------- Bach	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
31-------------------- Belleville	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
32C*:					
Plainfield------------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: too sandy.
Covert----------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
34-------------------- Aurelius	Severe: floods, wetness, excess humus.	Severe: wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: wetness, excess humus.	Severe: floods, wetness, excess humus.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
36A------------------- Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Severe: wetness, too sandy.
38A------------------- Mitiwanga	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: wetness, thin layer.
39A------------------- Rapson	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.
40A------------------- Wasepi	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.
42A------------------- Tyre	Severe: wetness, floods.	Moderate: wetness, too sandy, floods.	Severe: wetness, floods.	Moderate: wetness, too sandy, floods.	Moderate: too sandy, wetness, thin layer.
43-------------------- Tobico	Severe: floods, wetness, excess humus.	Severe: excess humus, wetness.	Severe: floods, excess humus, wetness.	Severe: excess humus, wetness.	Severe: wetness, floods.
44A------------------- Badaxe	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: small stones, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, small stones.
45-------------------- Granby	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
46-------------------- Linwood	Severe: floods, wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness, floods.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.
49B*:					
Grindstone-----------	Severe: percs slowly.	Moderate: wetness.	Severe: percs slowly.	Slight----------	Slight.
Kilmanagh------------	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
50A*:					
Shebeon--------------	Severe: wetness, percs slowly, floods.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
Badaxe---------------	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
51B*:					
Guelph---------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Londo----------------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
51C------------------- Guelph	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
51D------------------- Guelph	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
53B------------------- Shebeon	Severe: wetness, percs slowly, floods.	Moderate: wetness, small stones.	Severe: wetness, small stones, percs slowly.	Moderate: wetness, small stones.	Moderate: small stones, wetness.
54B------------------- Grindstone	Severe: percs slowly.	Moderate: wetness, small stones.	Severe: small stones, percs slowly.	Moderate: small stones.	Moderate: small stones.
55-------------------- Kilmanagh	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
56A*:					
Riverdale------------	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.
Pipestone------------	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Severe: wetness, too sandy.
57A------------------- Londo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
58-------------------- Parkhill	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
60-------------------- Pinnebog	Severe: excess humus, floods, wetness.	Severe: excess humus, wetness.	Severe: excess humus, floods, wetness.	Severe: excess humus, wetness.	Severe: floods, wetness, excess humus.
62-------------------- Essexville	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
63*. Pits					
64*. Udipsamments					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
3A------------------ Shebeon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
4B------------------ Grindstone	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
5------------------- Kilmanagh	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
6A------------------ Avoca	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
7A------------------ Aubarque	Poor	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair.
7B------------------ Aubarque	Poor	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor.
9B------------------ Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
9C------------------ Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
11A----------------- Covert	Poor	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
12A----------------- Sanilac	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
13B----------------- Gagetown	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
14A----------------- Badaxe	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
15B----------------- Deerton Variant	Very poor.	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
18------------------ Tappan	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
19------------------ Corunna	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
20A----------------- Covert	Poor	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
23*. Fluvaquents										
24*: Aquents.										
Histosols.										
26B, 26C------------ Boyer	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
27------------------ Filion	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
28B*:										
Covert	Poor	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
Tobico	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair.
29A*:										
Pipestone	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor.
Tobico	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair.
Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
30 Bach	Good	Good	Poor	Poor	Poor	Good	Good	Good	Poor	Good.
31 Belleville	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair.
32C*:										
Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Covert	Poor	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
34 Aurelius	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
36A Pipestone	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor.
38A Mitiwanga	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
39A Rapson	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Fair	Fair.
40A Wasepi	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
42A Tyre	Very poor.	Poor	Poor	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor.
43 Tobico	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair.
44A Badaxe	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
45 Granby	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
46 Linwood	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
49B*:										
Grindstone	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Kilmanagh	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
50A*:										
Shebeon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Badaxe	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
51B*:										
Guelph	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
51C Guelph	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
51D Guelph	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
53B Shebeon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
54B Grindstone	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
55 Kilmanagh	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
56A*:										
Riverdale	Poor	Fair	Good	Fair	Fair	Fair	Poor	Fair	Fair	Poor.
Pipestone	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor.
57A Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
58 Parkhill	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
60 Pinnebog	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
62 Essexville	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Fair.
63*. Pits										
64*. Udipsamments										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
3A-----Shebeon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness.	Moderate: wetness.
4B-----Grindstone	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, low strength.	Slight.
5-----Kilmanagh	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: frost action, wetness, floods.	Severe: wetness, floods.
6A-----Avoca	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: frost action, wetness.	Moderate: too sandy, wetness.
7A, 7B-----Aubarque	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness.	Severe: wetness.
9B-----Plainfield	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Severe: too sandy.
9C-----Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too sandy.
11A-----Covert	Severe: cutbanks cave, wetness, too clayey.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Moderate: wetness.	Severe: too sandy.
12A-----Sanilac	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
13B-----Gagetown	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Moderate: wetness.
14A-----Badaxe	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
15B-----Deerton Variant	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: too sandy, small stones, thin layer.
18-----Tappan	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
19-----Corunna	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
20A-----Covert	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: too sandy.
23*. Fluvaquents						
24*: Aquents.						

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
24*: Histosols.						
26B----------- Boyer	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: too sandy.
26C----------- Boyer	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: too sandy, slope.
27------------ Filion	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, low strength, floods.	Severe: wetness, floods, small stones.
28B*:						
Covert-----------	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: too sandy.
Tobico-----------	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
29A*:						
Pipestone--------	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.
Tobico-----------	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Adrian-----------	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: excess humus, floods, wetness.
30------------ Bach	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.	Severe: wetness, floods.
31------------ Belleville	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.	Severe: floods, wetness.
32C*:						
Plainfield-------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: too sandy.
Covert-----------	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: too sandy.
34------------ Aurelius	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: floods, wetness, excess humus.
36A----------- Pipestone	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.
38A----------- Mitiwanga	Severe: depth to rock, wetness.	Severe: wetness.	Severe: depth to rock, wetness.	Severe: wetness.	Severe: frost action, low strength.	Severe: wetness, thin layer.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
39A--------------- Rapson	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, too sandy.
40A--------------- Wasepi	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Moderate: wetness, too sandy.
42A--------------- Tyre	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.	Moderate: too sandy, wetness, thin layer.
43---------------- Tobico	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
44A--------------- Badaxe	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, small stones.
45---------------- Granby	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
46---------------- Linwood	Severe: wetness, floods, excess humus.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, excess humus.
49B*:						
Grindstone--------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, low strength.	Slight.
Kilmanagh---------	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: frost action, wetness, floods.	Severe: wetness, floods.
50A*:						
Shebeon-----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness.	Moderate: wetness.
Badaxe------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
51B*:						
Guelph------------	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action, low strength.	Slight.
Londo-------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Moderate: wetness.
51C--------------- Guelph	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, slope, low strength.	Moderate: slope.
51D--------------- Guelph	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
53B--------------- Shebeon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness.	

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
54B: Grindstone	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action, low strength.	Moderate: small stones.
55: Kilmanagh	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: frost action, wetness, floods.	Severe: wetness, floods.
56A*:						
Riverdale	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, too sandy.
Pipestone	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.
57A: Londo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Moderate: wetness.
58: Parkhill	Severe: wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: low strength, floods, wetness.	Severe: wetness, floods.
60: Pinnebog	Severe: floods, wetness, excess humus.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, excess humus.
62: Essexville	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, low strength.	Severe: wetness.
63*. Pits						
64*. Udipsamments						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
3A------------------ Shebeon	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
4B------------------ Grindstone	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Good.
5------------------- Kilmanagh	Severe: wetness, percs slowly, floods.	Slight-----------	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
6A------------------ Avoca	Severe: percs slowly, wetness.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
7A------------------ Aubarque	Severe: percs slowly, wetness.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
7B------------------ Aubarque	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
9B------------------ Plainfield	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
9C------------------ Plainfield	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
11A----------------- Covert	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness, too sandy.	Severe: wetness, seepage.	Poor: too sandy.
12A----------------- Sanilac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
13B----------------- Gagetown	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
14A----------------- Badaxe	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
15B----------------- Deerton Variant	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage, too sandy.	Severe: seepage.	Poor: area reclaim, seepage, small stones.
18------------------ Tappan	Severe: wetness, percs slowly, floods.	Slight-----------	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
19------------------ Corunna	Severe: wetness, percs slowly, floods.	Severe: wetness, seepage.	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Poor: wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
20A Covert	Severe: wetness.	Severe: seepage, wetness.	Severe: too sandy, wetness, seepage.	Severe: seepage, wetness.	Poor: too sandy, seepage.
23*. Fluvaquents					
24*: Aquents.					
Histosols.					
26B Boyer	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
26C Boyer	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
27 Filion	Severe: wetness, percs slowly, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
28B*: Covert	Severe: wetness.	Severe: seepage, wetness.	Severe: too sandy, wetness, seepage.	Severe: seepage, wetness.	Poor: too sandy, seepage.
Tobico	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Poor: wetness, seepage, too sandy.
29A*: Pipestone	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage, wetness.
Tobico	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Poor: wetness, seepage, too sandy.
Adrian	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: hard to pack, wetness.
30 Bach	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
31 Belleville	Severe: wetness, percs slowly, floods.	Severe: wetness, seepage.	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Poor: wetness.
32C*: Plainfield	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
32C*:					
Covert	Severe: wetness.	Severe: seepage, wetness.	Severe: too sandy, wetness, seepage.	Severe: seepage, wetness.	Poor: too sandy, seepage.
34 Aurelius	Severe: floods, wetness, subsides.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Poor: wetness.
36A Pipestone	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage, wetness.
38A Mitiwanga	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: wetness.	Poor: wetness, area reclaim.
39A Rapson	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, wetness.
40A Wasepi	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
42A Tyre	Severe: depth to rock, wetness, floods.	Severe: wetness, seepage.	Severe: depth to rock, seepage, floods.	Severe: wetness, seepage, floods.	Poor: too sandy, area reclaim, wetness.
43 Tobico	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Poor: wetness, seepage, too sandy.
44A Badaxe	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
45 Granby	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Poor: wetness, too sandy, seepage.
46 Linwood	Severe: wetness, floods, subsides.	Severe: seepage, floods, excess humus.	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Poor: wetness, hard to pack.
49B*:					
Grindstone	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Good.
Kilmanagh	Severe: wetness, percs slowly, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
50A*:					
Shebeon	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
50A*:					
Badaxe	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
51B*:					
Guelph	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: too clayey.
Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
51C: Guelph	Moderate: percs slowly, slope.	Severe: slope.	Slight	Moderate: slope.	Fair: too clayey, slope.
51D: Guelph	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
53B: Shebeon	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
54B: Grindstone	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Good.
55: Kilmanagh	Severe: wetness, percs slowly, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
56A*:					
Riverdale	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, too sandy, seepage.	Severe: wetness, seepage.	Poor: small stones, too sandy, seepage.
Pipestone	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage, wetness.
57A: Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
58: Parkhill	Severe: wetness, percs slowly, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
60: Pinnebog	Severe: floods, wetness, percs slowly.	Severe: excess humus, seepage, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness, excess humus.
62: Essexville	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Poor: wetness.
63*. Pits					

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
64*. Udipsamments					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
3A----------- Shebeon	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
4B----------- Grindstone	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
5------------ Kilmanagh	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
6A----------- Avoca	Poor: wetness.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
7A, 7B------- Aubarque	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
9B, 9C------- Plainfield	Good	Good	Unsuited: excess fines.	Poor: too sandy.
11A---------- Covert	Fair: thin layer, wetness.	Fair: thin layer, excess fines.	Unsuited: excess fines.	Poor: too sandy.
12A---------- Sanilac	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
13B---------- Gagetown	Fair: wetness, low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
14A---------- Badaxe	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
15B---------- Deerton Variant	Poor: thin layer, area reclaim.	Poor: thin layer.	Unsuited: excess fines.	Poor: small stones, thin layer.
18----------- Tappan	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
19----------- Corunna	Poor: wetness.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: wetness.
20A---------- Covert	Fair: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
23*. Fluvaquents				
24*: Aquents.				
Histosols.				
26B---------- Boyer	Good	Good	Good	Fair: too sandy.
26C---------- Boyer	Good	Good	Good	Fair: too sandy, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
27 Filion	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, small stones.
28B*:				
Covert	Fair: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Tobico	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness.
29A*:				
Pipestone	Poor: wetness.	Good	Unsuited: excess fines.	Poor: too sandy, wetness.
Tobico	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness.
Adrian	Poor: wetness, low strength.	Good	Unsuited: excess fines, excess humus.	Poor: wetness, excess humus.
30 Bach	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
31 Belleville	Poor: wetness, low strength.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: wetness.
32C*:				
Plainfield	Good	Good	Unsuited: excess fines.	Poor: too sandy.
Covert	Fair: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
34 Aurelius	Poor: wetness.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.
36A Pipestone	Poor: wetness.	Good	Unsuited: excess fines.	Poor: too sandy, wetness.
38A Mitiwanga	Poor: wetness, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
39A Rapson	Poor: wetness.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
40A Wasepi	Poor: wetness.	Poor: thin layer.	Poor: thin layer.	Fair: too sandy.
42A Tyre	Poor: area reclaim, thin layer, wetness.	Poor: thin layer.	Unsuited: excess fines.	Poor: too sandy, small stones.
43 Tobico	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness.
44A Badaxe	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
45------------------- Granby	Poor: wetness.	Good----------------	Unsuited: excess fines.	Poor: wetness.
46------------------- Linwood	Poor: wetness, low strength.	Unsuited: excess humus.	Unsuited: excess humus, excess fines.	Poor: wetness, excess humus.
49B*:				
Grindstone-----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Kilmanagh------------	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
50A*:				
Shebeon--------------	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Badaxe---------------	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
51B*:				
Guelph---------------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Londo----------------	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
51C------------------ Guelph	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
51D------------------ Guelph	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
53B------------------ Shebeon	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones, large stones.
54B------------------ Grindstone	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
55------------------- Kilmanagh	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
56A*:				
Riverdale------------	Poor: wetness.	Good----------------	Good----------------	Fair: too sandy, small stones.
Pipestone------------	Poor: wetness.	Good----------------	Unsuited: excess fines.	Poor: too sandy, wetness.
57A------------------ Londo	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
58------------------- Parkhill	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
60------------------- Pinnebog	Poor: low strength, wetness.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
62-------------------- Essexville	Poor: wetness, low strength.	Poor: thin layer.	Unsuited: excess fines.	Poor: wetness.
63*. Pits				
64*. Udipsamments				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
3A Shebeon	Favorable	Wetness	Slow refill	Percs slowly, frost action.	Wetness	Wetness, percs slowly.
4B Grindstone	Favorable	Wetness	Slow refill	Percs slowly, frost action.	Percs slowly, wetness.	Percs slowly.
5 Kilmanagh	Favorable	Wetness	Slow refill	Frost action, floods.	Not needed	Wetness, percs slowly.
6A Avoca	Seepage	Wetness	Slow refill	Favorable	Wetness, too sandy, soil blowing.	Wetness.
7A, 7B Aubarque	Favorable	Wetness	Slow refill	Percs slowly, frost action.	Wetness, percs slowly.	Percs slowly, wetness.
9B Plainfield	Seepage, slope.	Seepage	No water	Not needed	Too sandy, soil blowing.	Droughty.
9C Plainfield	Seepage, slope.	Seepage	No water	Not needed	Slope, too sandy, soil blowing.	Droughty, slope.
11A Covert	Seepage	Seepage	Slow refill	Favorable	Wetness, too sandy, soil blowing.	Droughty, percs slowly.
12A Sanilac	Seepage	Wetness	Slow refill	Frost action	Wetness	Erodes easily, wetness.
13B Gagetown	Seepage	Piping, wetness.	Slow refill	Frost action	Wetness, erodes easily.	Erodes easily.
14A Badaxe	Favorable	Piping, wetness.	Slow refill	Percs slowly, frost action.	Wetness, soil blowing, percs slowly.	Droughty, wetness, erodes easily.
15B Deerton Variant	Depth to rock, seepage.	Thin layer, seepage.	No water	Not needed	Too sandy, depth to rock.	Droughty, depth to rock.
18 Tappan	Favorable	Wetness	Slow refill	Percs slowly, floods, frost action.	Not needed	Wetness, percs slowly.
19 Corunna	Favorable	Wetness	Slow refill	Floods, frost action.	Not needed	Wetness.
20A Covert	Seepage	Seepage, wetness.	Deep to water	Favorable	Wetness, too sandy, soil blowing.	Droughty.
23*. Fluvaquents						
24*: Aquents.						
Histosols.						
26B Boyer	Slope, seepage.	Seepage	No water	Not needed	Soil blowing, too sandy.	Droughty.
26C Boyer	Slope, seepage.	Seepage	No water	Not needed	Slope, soil blowing, too sandy.	Slope, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
27 Filion	Favorable	Wetness	Slow refill	Percs slowly, floods, frost action.	Not needed	Wetness, droughty, percs slowly.
28B*:						
Covert	Seepage	Seepage, wetness.	Deep to water	Favorable	Wetness, too sandy, soil blowing.	Droughty.
Tobico	Seepage	Seepage, piping, wetness.	Favorable	Floods	Not needed	Wetness, droughty.
29A*:						
Pipestone	Seepage	Seepage, piping, wetness.	Favorable	Favorable	Too sandy, soil blowing, wetness.	Droughty, wetness.
Tobico	Seepage	Seepage, piping, wetness.	Favorable	Floods	Not needed	Wetness, droughty.
Adrian	Seepage	Seepage, wetness.	Slow refill	Floods, frost action.	Not needed	Wetness.
30 Bach	Seepage	Piping, wetness.	Slow refill	Frost action, floods.	Wetness	Wetness.
31 Belleville	Favorable	Wetness	Slow refill	Floods, frost action.	Not needed	Wetness.
32C*:						
Plainfield	Seepage, slope.	Seepage	No water	Not needed	Too sandy, soil blowing.	Droughty.
Covert	Seepage	Seepage, wetness.	Deep to water	Favorable	Wetness, too sandy, soil blowing.	Droughty.
34 Aurelius	Seepage	Wetness	Favorable	Floods, excess humus, frost action.	Not needed	Wetness.
36A Pipestone	Seepage	Seepage, piping, wetness.	Favorable	Favorable	Too sandy, soil blowing, wetness.	Droughty, wetness.
38A Mitiwanga	Depth to rock, seepage.	Thin layer, piping.	Slow refill	Depth to rock, frost action.	Wetness, depth to rock.	Wetness, depth to rock.
39A Rapson	Seepage	Piping, wetness.	Slow refill	Favorable	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
40A Wasepi	Seepage	Seepage, wetness.	Slow refill	Frost action	Soil blowing, wetness, too sandy.	Wetness, droughty.
42A Tyre	Depth to rock, seepage.	Thin layer, seepage.	Favorable	Depth to rock, floods.	Not needed	Wetness, droughty, depth to rock.
43 Tobico	Seepage	Seepage, piping, wetness.	Favorable	Floods	Not needed	Wetness, droughty.
44A Badaxe	Favorable	Piping, wetness.	Slow refill	Percs slowly, frost action.	Wetness, percs slowly.	Droughty, wetness, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
45 Granby	Seepage	Seepage, wetness.	Favorable	Floods	Not needed	Wetness, droughty.
46 Linwood	Seepage	Wetness, excess humus.	Slow refill	Floods, frost action, excess humus.	Not needed	Wetness.
49B*:						
Grindstone	Favorable	Wetness	Slow refill	Percs slowly, frost action.	Percs slowly, wetness.	Percs slowly.
Kilmanagh	Favorable	Wetness	Slow refill	Frost action, floods.	Not needed	Wetness, percs slowly.
50A*:						
Shebeon	Favorable	Wetness	Slow refill	Percs slowly, frost action.	Wetness, soil blowing.	Wetness, percs slowly.
Badaxe	Favorable	Piping, wetness.	Slow refill	Percs slowly, frost action.	Wetness, soil blowing, percs slowly.	Droughty, wetness, erodes easily.
51B*:						
Guelph	Seepage	Favorable	No water	Not needed	Favorable	Favorable.
Londo	Favorable	Wetness	Slow refill	Frost action	Wetness	Wetness.
51C Guelph	Seepage, slope.	Favorable	No water	Not needed	Favorable	Slope.
51D Guelph	Seepage, slope.	Favorable	No water	Not needed	Slope	Slope.
53B Shebeon	Favorable	Wetness	Slow refill	Percs slowly, frost action.	Wetness	Wetness, percs slowly.
54B Grindstone	Favorable	Wetness	Slow refill	Percs slowly, frost action.	Percs slowly, wetness.	Percs slowly.
55 Kilmanagh	Favorable	Wetness	Slow refill	Frost action, floods.	Not needed	Wetness, percs slowly.
56A*:						
Riverdale	Seepage	Seepage, wetness.	Favorable	Favorable	Wetness, too sandy, soil blowing.	Droughty, wetness.
Pipestone	Seepage	Seepage, piping, wetness.	Favorable	Favorable	Too sandy, soil blowing, wetness.	Droughty, wetness.
57A Londo	Favorable	Wetness	Slow refill	Frost action	Wetness	Wetness.
58 Parkhill	Seepage	Wetness	Slow refill	Floods, frost action.	Not needed	Wetness.
60 Pinnebog	Seepage	Excess humus, wetness.	Favorable	Floods, frost action, excess humus.	Not needed	Wetness.
62 Essexville	Favorable	Wetness	Slow refill	Frost action, floods.	Wetness	Wetness.
63*. Pits						
64*. Udipsamments						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
3A----------------- Shebeon	0-11	Loam------------	ML	A-4	0-10	85-100	80-95	70-90	50-75	20-35	NP-10
	11-23	Loam, clay loam	CL-ML, CL	A-4, A-6	0-10	85-100	80-95	65-90	50-80	20-40	4-23
	23-33	Sandy loam, loam	CL-ML, SC, CL, SM-SC	A-4, A-6	0-10	85-100	80-95	65-90	35-75	15-25	5-12
	33-60	Sandy loam, loam	CL-ML, SC, CL, SM-SC	A-4, A-6	0-10	85-100	80-95	65-90	35-75	15-25	5-12
4B----------------- Grindstone	0-9	Loam------------	SM-SC, SC, CL-ML, CL	A-4	0-10	85-100	80-100	55-95	35-75	15-25	5-10
	9-27	Loam, silt loam, clay loam.	CL-ML, CL	A-4, A-6	0-10	85-100	80-100	55-95	50-80	20-38	5-19
	27-60	Loam, clay loam	SM-SC, CL, CL-ML, SC	A-4, A-6	0-10	85-100	80-100	55-95	45-75	20-38	5-19
5------------------ Kilmanagh	0-9	Loam------------	ML, CL, CL-ML	A-4	0-10	85-100	80-95	80-90	50-70	<25	NP-10
	9-29	Loam------------	CL-ML, CL	A-4, A-6, A-2	0-10	85-100	80-95	65-90	60-75	20-35	5-18
	29-44	Sandy loam, loam	ML, CL, SM, SC	A-4, A-6, A-2	0-10	85-100	80-95	50-90	25-75	<25	NP-12
	44-60	Sandy loam, loam	ML, CL, SM, SC	A-4, A-6, A-2	0-10	85-100	80-95	50-90	25-75	<25	NP-12
6A----------------- Avoca	0-6	Loamy sand------	SM	A-2-4	0	100	95-100	50-75	15-35	<20	NP-4
	6-39	Fine sand, sand, loamy sand.	SM, SP-SM	A-1, A-2-4, A-3	1-5	95-100	85-95	40-70	5-25	<20	NP-4
	39-60	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	90-95	85-90	75-90	50-85	15-36	4-18
7A, 7B------------- Aubarque	0-12	Loam------------	CL, CL-ML	A-4, A-6	0-10	85-100	80-95	70-90	50-85	18-30	6-15
	12-17	Loam, silt loam	CL, CL-ML	A-4, A-6	0-10	85-100	80-95	70-95	50-75	18-35	6-19
	17-60	Loam------------	CL, CL-ML	A-4, A-6	0-10	85-100	80-95	70-90	50-75	18-30	6-15
9B, 9C------------- Plainfield	0-20	Sand------------	SP-SM, SM, SP	A-3, A-2	0	75-100	75-100	40-80	3-35	---	NP
	20-60	Sand------------	SP	A-3, A-1, A-2	0	75-100	75-100	40-70	1-4	---	NP
11A---------------- Covert	0-10	Sand------------	SM, SP-SM	A-2-4, A-3	0	95-100	90-100	50-75	5-25	---	NP
	10-47	Sand------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	47-60	Clay loam, loam	CL, CL-ML, ML	A-4, A-6	0-5	90-100	90-100	75-100	50-90	25-40	3-15

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
12A------------------ Sanilac	0-13	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	90-100	70-90	25-35	5-10
	13-25	Very fine sandy loam, silt loam, very fine sand.	ML, SM	A-4	0	100	100	75-95	35-60	<25	NP-4
	25-60	Stratified loamy very fine sand to silt loam.	SM, SC, ML, CL	A-4	0	100	80-100	75-95	35-60	15-30	NP-10
13B------------------ Gagetown	0-12	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-35	3-15
	12-60	Stratified fine sand to silt loam.	ML, SM, SC, CL	A-4, A-6	0	100	100	70-100	40-90	15-30	NP-15
14A------------------ Badaxe	0-10	Fine sandy loam	SM, SM-SC, SC	A-4, A-2	0-10	85-100	80-95	50-85	25-50	15-28	NP-10
	10-15	Loamy sand, sandy loam.	SM, SM-SC, SC	A-1, A-2, A-4	0-10	85-100	80-95	40-75	12-40	10-28	NP-10
	15-27	Loam, sandy loam	SM, SC, ML, CL	A-4, A-2	0-10	85-100	80-95	50-90	25-70	10-28	NP-10
	27-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-10	85-100	80-95	70-95	50-75	20-38	7-20
15B------------------ Deerton Variant	0-6	Gravelly loamy sand.	SM, SM-SC, SC, SP-SM	A-2-4, A-1-b	0-10	85-95	70-80	35-60	10-25	<20	NP-10
	6-22	Very cobbly coarse sand.	SP, SP-SM	A-1-b	15-25	70-85	55-75	25-50	0-10	---	NP
	22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
18------------------- Tappan	0-13	Loam------------	CL, ML, CL-ML	A-4, A-6	0-5	90-100	90-95	65-95	50-80	20-35	3-15
	13-31	Loam, silt loam, clay loam.	CL	A-6	0-5	90-100	90-95	85-95	55-80	20-40	10-25
	31-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	90-100	90-95	85-95	55-75	20-35	5-15
19------------------- Corunna	0-11	Sandy loam-------	SM, ML, SC, CL	A-2, A-4	0-5	95-100	95-100	65-85	25-70	<30	NP-10
	11-36	Sandy loam, gravelly sandy loam, loamy sand.	SM, SC, SM-SC	A-4, A-2	0-5	95-100	85-100	50-75	15-40	<30	NP-10
	36-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	70-90	25-50	11-25
20A------------------ Covert	0-10	Sand------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	10-35	Sand------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
	35-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
23*. Fluvaquents											
24*: Aquents.											
Histosols.											

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
26B, 26C------------ Boyer	0-17	Loamy sand, sand	SM, SM-SC	A-2, A-1	0-5	95-100	65-95	45-75	15-30	<20	NP-6
	17-23	Sandy loam, loam, gravelly loam.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	23-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
27------------------ Filion	0-14	Stony loam, loam	CL, SC	A-4, A-6	15-20	85-100	75-100	65-95	45-75	20-30	7-15
	14-60	Loam, clay loam	CL	A-4, A-6	0-10	85-100	80-100	70-100	51-80	20-40	7-27
28B*:											
Covert------------	0-10	Sand------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	10-35	Sand------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
	35-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
Tobico------------	0-28	Mucky loamy sand	SM, SP-SM	A-2, A-3	0	100	90-100	60-80	5-30	<20	NP-4
	28-60	Sand, fine sand	SP-SM, SP, SM	A-1, A-2, A-3	0	75-100	70-100	35-75	0-30	---	NP
29A*:											
Pipestone---------	0-10	Sand------------	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	10-36	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	36-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP
Tobico------------	0-28	Mucky sandy loam	SM, SP-SM	A-2, A-3	0	100	90-100	60-80	5-30	<20	NP-4
	28-60	Sand, loamy sand, gravelly sand.	SP-SM, SP, SM	A-1, A-2, A-3	0	75-100	70-100	35-75	0-30	---	NP
Adrian------------	0-28	Sapric material	PT	A-8	---	---	---	---	---	---	---
	28-60	Sand, loamy sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
30------------------ Bach	0-10	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	65-90	20-35	2-12
	10-60	Very fine sandy loam, silt loam, very fine sand.	ML, SM	A-2-4, A-4	0	100	80-100	70-95	25-95	<35	NP-4
31------------------ Belleville	0-11	Loamy sand------	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
	11-31	Fine sand, loamy sand, loamy fine sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	31-60	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
32C*:											
Plainfield--------	0-20	Sand------------	SP-SM, SM, SP	A-3, A-2	0	75-100	75-100	40-80	3-35	---	NP
	20-60	Sand------------	SP	A-3, A-1, A-2	0	75-100	75-100	40-70	1-4	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
32C*: Covert	0-10	Sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	10-35	Sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
	35-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
34 Aurelius	0-8	Sapric material	PT	A-8	0	---	---	---	---	---	---
	8-24	Marl	---	---	0	100	95-100	80-90	60-80	---	---
	24-60	Stratified sand to clay loam.	SM, ML	A-2, A-4	0	95-100	90-100	70-90	30-80	<40	NP-10
36A Pipestone	0-10	Sand	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	10-36	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	36-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP
38A Mitiwanga	0-12	Cobbly sandy loam, sandy loam.	ML, CL-ML	A-4	0-2	90-100	85-95	75-90	60-80	25-35	4-10
	12-23	Silt loam, silty clay loam, loam.	CL, ML, CL-ML	A-6, A-4	0-4	80-90	75-90	65-85	55-80	20-40	3-18
	23	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
39A Rapson	0-25	Loamy sand, sand	SP-SM, SM	A-2-4, A-3	0	95-100	95-100	50-75	5-25	---	NP
	25-60	Stratified very fine sand to silt loam.	ML, CL, SM, SC	A-4	0	100	100	75-90	40-80	<25	NP-10
40A Wasepi	0-13	Loamy sand	SM	A-2-4	0-5	90-100	85-95	60-95	15-30	---	NP
	13-26	Loamy sand, gravelly sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6, A-1	0-5	90-100	85-95	35-85	15-45	10-30	NP-16
	26-45	Sand, gravelly sand, gravel.	SP, GP, SP-SM, GP-GM	A-1, A-3, A-2-4	0-10	40-75	35-70	20-55	0-10	---	NP
	45-60	Clay loam, silty clay loam, loam.	CL, CH	A-6, A-7	0-5	95-100	90-100	85-100	70-90	25-60	15-35
42A Tyre	0-5	Loamy sand	SM, SM-SC, SC	A-2, A-1-b	0-10	90-100	85-95	40-70	15-30	<20	NP-10
	5-25	Sand, loamy sand, cobbly sand.	SM, SP-SM	A-2, A-3, A-1-b	5-30	85-95	70-85	35-70	5-30	---	NP
	25	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
43 Tobico	0-8	Mucky sandy loam	SM, SP-SM	A-2, A-3	0	100	90-100	60-80	5-30	<20	NP-4
	8-60	Sand, loamy sand, gravelly sand.	SP-SM, SP, SM	A-1, A-2, A-3	0	75-100	70-100	35-75	0-30	---	NP
44A Badaxe	0-7	Cobbly sandy loam.	SM, SM-SC, SC	A-1, A-2	10-25	75-85	70-80	40-55	20-30	10-25	NP-10
	7-12	Loamy sand, sandy loam.	SM, SM-SC, SC	A-1, A-2, A-4	0-10	85-100	80-95	40-75	12-40	10-28	NP-10
	12-34	Loam, sandy loam	SM, SC, ML, CL	A-4, A-2	0-10	85-100	80-95	50-90	25-70	10-28	NP-10
	34-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-10	85-100	80-95	70-95	50-75	20-38	7-20

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
45----------------- Granby	0-11	Loamy sand------	SM	A-2	0	100	100	50-75	15-30	---	NP
	11-60	Sand, fine sand, loamy sand.	SP, SP-SM, SM	A-3, A-2	0	100	95-100	50-75	0-20	---	NP
	32-60	Sand, fine sand	SP	A-3, A-2	0	100	95-100	50-70	0-5	---	NP
46----------------- Linwood	0-25	Sapric material	PT	A-8	0	---	---	---	---	---	---
	25-60	Silt loam, sandy loam, silty clay loam.	CL, ML, SM, SC	A-4, A-6	0	100	95-100	60-100	35-95	15-40	NP-20
49B*: Grindstone---------	0-9	Loam------------	SM-SC, SC, CL-ML, CL	A-4	0-10	85-100	80-100	55-95	35-75	15-25	5-10
	9-27	Loam, silt loam, clay loam.	CL-ML, CL	A-4, A-6	0-10	85-100	80-100	55-95	50-80	20-38	5-19
	27-60	Loam, clay loam	SM-SC, CL, CL-ML, SC	A-4, A-6	0-10	85-100	80-100	55-95	45-75	20-38	5-19
Kilmanagh---------	0-9	Loam------------	ML, CL, CL-ML	A-4	0-10	85-100	80-95	80-90	50-70	<25	NP-10
	9-29	Loam------------	CL-ML, CL	A-4, A-6, A-2	0-10	85-100	80-95	65-90	60-75	20-35	5-18
	29-44	Sandy loam, loam	ML, CL, SM, SC	A-4, A-6, A-2	0-10	85-100	80-95	50-90	25-75	<25	NP-12
	44-60	Sandy loam, loam	ML, CL, SM, SC	A-4, A-6, A-2	0-10	85-100	80-95	50-90	25-75	<25	NP-12
50A*: Shebeon-----------	0-11	Sandy loam------	SM, SM-SC, SC	A-2-4, A-4	0-10	85-100	80-95	50-70	25-40	<20	NP-8
	11-23	Loam, clay loam	CL-ML, CL	A-4, A-6	0-10	85-100	80-95	65-90	50-80	20-40	4-23
	23-33	Sandy loam, loam	CL-ML, SC, CL, SM-SC	A-4, A-6	0-10	85-100	80-95	65-90	35-75	15-25	5-12
	33-60	Sandy loam, loam	CL-ML, SC, CL, SM-SC	A-4, A-6	0-10	85-100	80-95	65-90	35-75	15-25	5-12
Badaxe------------	0-10	Sandy loam------	SM, SM-SC, SC	A-4, A-2	0-10	85-100	80-95	50-85	25-50	15-28	NP-10
	10-15	Loamy sand, sandy loam.	SM, SM-SC, SC	A-1, A-2, A-4	0-10	85-100	80-95	40-75	12-40	10-28	NP-10
	15-27	Loam, sandy loam	SM, SC, ML, CL	A-4, A-2	0-10	85-100	80-95	50-90	25-70	10-28	NP-10
	27-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-10	85-100	80-95	70-95	50-75	20-38	7-20
51B*: Guelph------------	0-9	Loam------------	ML, SM, SC, CL	A-4, A-2, A-6	0-5	95-100	90-95	55-90	25-70	20-35	2-12
	9-21	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-90	70-85	25-40	5-20
	21-60	Loam, clay loam	CL-ML, CL	A-6, A-4	0-5	95-100	85-95	75-95	55-75	20-30	4-14

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
51B*:											
Londo	0-9	Loam	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	9-20	Clay loam, loam	CL	A-6	0	95-100	90-100	85-95	65-80	25-40	11-25
	20-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	25-35	5-15
51C, 51D: Guelph	0-9	Loam	ML, SM, SC, CL	A-4, A-2, A-6	0-5	95-100	90-95	55-90	25-70	20-35	2-12
	9-21	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-90	70-85	25-40	5-20
	21-60	Loam, clay loam	CL-ML, CL	A-6, A-4	0-5	95-100	85-95	75-95	55-75	20-30	4-14
53B: Shebeon	0-9	Cobbly loam	SM, SC, ML, CL	A-2-4, A-4	10-25	75-90	70-85	40-80	25-65	<20	NP-8
	9-25	Loam, clay loam	CL-ML, CL	A-4, A-6	0-10	85-100	80-95	65-90	50-80	20-40	4-23
	25-37	Sandy loam, loam	CL-ML, SC, CL, SM-SC	A-4, A-6	0-10	85-100	80-95	65-90	35-75	15-25	5-12
	37-60	Sandy loam, loam	CL-ML, SC, CL, SM-SC	A-4, A-6	0-10	85-100	80-95	65-90	35-75	15-25	5-12
54B: Grindstone	0-7	Cobbly loam	SC, CL-ML, CL, SM-SC	A-4	10-25	75-85	70-80	60-75	40-60	15-25	5-10
	7-36	Loam, silt loam, clay loam.	CL-ML, CL	A-4, A-6	0-10	85-100	80-100	55-95	50-80	20-38	5-19
	36-60	Loam, clay loam	SM-SC, CL, CL-ML, SC	A-4, A-6	0-10	85-100	80-100	55-95	45-75	20-38	5-19
55: Kilmanagh	0-9	Cobbly loam	ML, CL, SM, SC	A-4	15-25	85-100	75-95	50-75	35-60	<25	NP-10
	9-34	Loam	CL-ML, CL	A-4, A-6, A-2	0-10	85-100	80-95	65-90	60-75	20-35	5-18
	34-43	Sandy loam, loam	ML, CL, SM, SC	A-4, A-6, A-2	0-10	85-100	80-95	50-90	25-75	<25	NP-12
	43-60	Sandy loam, loam	ML, CL, SM, SC	A-4, A-6, A-2	0-10	85-100	80-95	50-90	25-75	<25	NP-12
56A*:											
Riverdale	0-9	Loamy sand	SM, SP-SM	A-1, A-2, A-3	0-5	80-100	65-95	45-70	5-30	<20	NP-4
	9-21	Sand, loamy sand, gravelly sand.	SM, SP-SM	A-1, A-2, A-3	0-5	80-100	65-95	45-70	5-30	<20	NP-4
	21-25	Gravelly sandy loam, sandy loam.	SM, SC, SM-SC	A-2	0-5	85-100	65-90	55-75	15-35	12-35	NP-16
	25-60	Stratified sand to gravel.	SP, GP, SP-SM, GP-GM	A-1	0-10	40-80	35-70	20-45	0-10	---	NP
Pipestone	0-10	Sand	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	10-36	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	36-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
57A----------------- Londo	0-9	Loam-------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	9-20	Clay loam, loam	CL	A-6	0	95-100	90-100	85-95	65-80	25-40	11-25
	20-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	25-35	5-15
58----------------- Parkhill	0-9	Loam-------------	CL-ML, CL	A-4, A-6	0-5	95-100	90-100	85-95	60-85	20-40	6-18
	9-32	Clay loam, loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	85-100	65-95	25-40	10-20
	32-60	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	80-90	60-75	15-35	5-15
60----------------- Pinnebog	0-34	Sapric material	PT	A-8	0	---	---	---	---	---	---
	34-50	Hemic material	PT	A-8	0	---	---	---	---	---	---
	50-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
62----------------- Essexville	0-12	Loamy sand------	SM, SM-SC	A-2, A-4	0	100	95-100	50-85	15-45	<20	NP-7
	12-22	Loamy fine sand, fine sand, sand.	SM, SM-SC, SP-SM	A-2, A-3, A-4, A-1	0	90-100	80-100	40-85	5-45	<25	NP-7
	22-60	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	95-100	90-100	80-95	55-90	20-38	8-25
63*. Pits											
64*. Udipsamments											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
3A---------------- Shebeon	0-11	10-24	1.43-1.73	0.6-2.0	0.15-0.22	6.6-7.8	Low----------	0.32	4	5	1-3
	11-23	18-30	1.44-1.81	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	23-33	18-32	1.44-1.81	0.2-2.0	0.08-0.19	7.4-8.4	Low----------	0.32			
	33-60	8-18	1.70-2.13	<0.06	0.04-0.08	7.4-8.4	Low----------	0.32			
4B---------------- Grindstone	0-9	8-20	1.31-1.78	0.6-2.0	0.10-0.22	6.6-7.8	Low----------	0.32	4	5	1-3
	9-27	18-35	1.31-1.86	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	27-60	12-28	1.70-2.13	<0.06	0.04-0.08	7.9-8.4	Low----------	0.32			
5----------------- Kilmanagh	0-9	15-22	1.12-1.59	0.6-2.0	0.16-0.20	6.6-7.8	Low----------	0.32	4	5	1-3
	9-29	18-30	1.48-1.80	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	29-44	18-30	1.48-1.80	0.2-2.0	0.10-0.18	7.4-8.4	Low----------	0.32			
	44-60	14-28	1.70-2.13	<0.06	0.05-0.09	7.4-8.4	Low----------	0.32			
6A---------------- Avoca	0-6	0-12	1.25-1.41	6.0-20	0.10-0.12	5.6-7.8	Low----------	0.17	5	2	1-4
	6-39	2-15	1.35-1.45	6.0-20	0.04-0.11	6.1-7.8	Low----------	0.17			
	39-60	18-35	1.25-1.50	0.2-0.6	0.14-0.20	7.9-8.4	Moderate-----	0.32			
7A, 7B------------ Aubarque	0-12	2-15	1.43-1.73	0.6-2.0	0.17-0.22	6.6-7.8	Low----------	0.32	3	5	1-3
	12-17	5-18	1.44-1.81	0.6-2.0	0.14-0.19	7.4-8.4	Low----------	0.32			
	17-60	8-18	1.70-2.13	<0.06	0.04-0.08	7.9-8.4	Low----------	0.32			
9B, 9C------------ Plainfield	0-20	4-9	1.35-1.65	6.0-20	0.04-0.09	4.5-7.3	Low----------	0.17	5	1	<1
	20-60	1-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.0	Low----------	0.17			
11A--------------- Covert	0-10	2-12	1.27-1.56	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.15	5	1	1-2
	10-47	2-10	1.26-1.60	6.0-20	0.05-0.08	4.5-7.3	Low----------	0.15			
	47-60	12-35	1.44-1.81	0.06-0.6	0.10-0.18	7.4-8.4	Moderate-----	0.32			
12A--------------- Sanilac	0-13	3-18	1.43-1.73	0.6-2.0	0.20-0.24	6.6-8.4	Low----------	0.37	5	4L	1-3
	13-25	0-18	1.44-1.81	0.2-2.0	0.06-0.22	7.9-8.4	Low----------	0.37			
	25-60	0-18	1.47-1.90	0.2-2.0	0.06-0.22	7.9-8.4	Low----------	0.37			
13B--------------- Gagetown	0-12	3-15	1.31-1.78	0.6-2.0	0.22-0.24	6.6-7.8	Low----------	0.32	5	5	1-3
	12-60	0-18	1.31-1.89	0.2-2.0	0.06-0.22	7.4-8.4	Low----------	0.43			
14A--------------- Badaxe	0-10	12-18	1.43-1.73	2.0-6.0	0.10-0.18	6.1-7.3	Low----------	0.24	4	3	1-3
	10-15	12-18	1.44-1.81	0.6-2.0	0.09-0.14	7.4-7.8	Low----------	0.24			
	15-27	12-18	1.44-1.81	0.6-2.0	0.10-0.18	7.4-7.8	Low----------	0.24			
	27-60	12-30	1.70-2.13	<0.06	0.03-0.05	7.9-8.4	Low----------	0.37			
15B--------------- Deerton Variant	0-6	0-8	1.14-1.60	2.0-20	0.06-0.09	5.1-6.0	Low----------	0.10	3	8	2-3
	6-22	2-10	1.26-1.59	2.0-20	0.02-0.04	5.1-6.0	Low----------	0.10			
	22	---	---	---	---	---	-------------	----			
18---------------- Tappan	0-13	15-25	1.12-1.59	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.28	5	5	1-4
	13-31	18-30	1.48-1.80	0.2-2.0	0.14-0.19	7.9-8.4	Low----------	0.28			
	31-60	15-28	1.46-1.95	0.06-0.2	0.15-0.19	7.9-8.4	Low----------	0.28			
19---------------- Corunna	0-11	5-15	1.61-1.73	0.6-6.0	0.14-0.22	6.1-7.8	Low----------	0.20	4	3	1-2
	11-36	10-18	1.29-1.83	0.6-6.0	0.08-0.14	6.1-7.8	Low----------	0.20			
	36-60	14-28	1.46-1.95	0.2-0.6	0.16-0.20	7.4-8.4	Moderate-----	0.43			
20A--------------- Covert	0-10	2-10	1.27-1.56	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.15	5	1	1-2
	10-35	2-10	1.26-1.60	6.0-20	0.05-0.08	4.5-7.3	Low----------	0.15			
	35-60	0-10	1.48-1.67	>20	0.04-0.07	5.6-7.3	Low----------	0.15			
23*. Fluvaquents											

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
24*:											
Aquents.											
Histosols.											
26B, 26C--------- Boyer	0-17 17-23 23-60	0-10 10-18 0-10	1.14-1.60 1.26-1.59 1.20-1.47	6.0-20 2.0-6.0 6.0-20	0.10-0.12 0.12-0.18 0.02-0.04	5.6-7.3 5.6-7.8 7.4-8.4	Low----------- Low----------- Low-----------	0.17 0.24 0.10	4-3	2	.5-3
27--------------- Filion	0-14 14-60	10-27 18-35	1.5-1.9 1.9-2.1	0.2-2.0 <0.06	0.14-0.18 0.03-0.06	6.6-8.4 7.9-8.4	Low----------- Low-----------	0.24 0.32	5	8	---
28B*:											
Covert-----------	0-10 10-35 35-60	2-10 2-10 0-10	1.27-1.56 1.26-1.60 1.48-1.67	6.0-20 6.0-20 >20	0.06-0.09 0.05-0.08 0.04-0.07	4.5-7.3 4.5-7.3 5.6-7.3	Low----------- Low----------- Low-----------	0.15 0.15 0.15	5	1	1-2
Tobico-----------	0-28 28-60	2-10 0-10	0.92-1.59 1.45-1.74	6.0-20 6.0-20	0.06-0.20 0.04-0.07	6.6-7.8 7.4-8.4	Low----------- Low-----------	0.15 0.15	5	2	4-6
29A*:											
Pipestone--------	0-10 10-36 36-60	2-12 2-12 2-12	0.63-1.57 1.22-1.57 1.22-1.57	6.0-20 6.0-20 >20	0.07-0.10 0.06-0.09 0.05-0.07	4.5-7.3 4.5-7.3 5.1-7.3	Low----------- Low----------- Low-----------	0.17 0.17 0.17	5	1	3-4
Tobico-----------	0-28 28-60	2-10 0-10	0.92-1.59 1.45-1.74	6.0-20 6.0-20	0.06-0.20 0.04-0.07	6.6-7.8 7.4-8.4	Low----------- Low-----------	0.15 0.15	5	2	4-6
Adrian-----------	0-28 28-60	--- ---	0.30-0.55 1.40-1.75	0.2-6.0 6.0-20	0.35-0.45 0.03-0.08	5.1-7.8 6.1-8.4	-------------- Low-----------	---- ----	---	2	55-75
30--------------- Bach	0-10 10-60	2-15 0-18	1.12-1.59 1.48-1.95	2.0-6.0 0.6-2.0	0.20-0.24 0.14-0.22	6.6-8.4 7.9-8.4	Low----------- Low-----------	0.28 0.28	5	5	1-4
31--------------- Belleville	0-11 11-31 31-60	3-12 2-12 27-35	0.92-1.59 1.45-1.73 1.46-1.95	6.0-20 6.0-20 0.2-0.6	0.10-0.12 0.06-0.10 0.14-0.20	6.1-7.8 6.1-8.4 7.4-8.4	Low----------- Low----------- Moderate-----	0.17 0.17 0.32	5	2	.5-3
32C*:											
Plainfield-------	0-20 20-60	4-9 1-4	1.35-1.65 1.50-1.65	6.0-20 6.0-20	0.04-0.09 0.04-0.07	4.5-7.3 4.5-6.0	Low----------- Low-----------	0.17 0.17	5	1	<1
Covert-----------	0-10 10-35 35-60	2-10 2-10 0-10	1.27-1.56 1.26-1.60 1.48-1.67	6.0-20 6.0-20 >20	0.06-0.09 0.05-0.08 0.04-0.07	4.5-7.3 4.5-7.3 5.6-7.3	Low----------- Low----------- Low-----------	0.15 0.15 0.15	5	1	1-2
34--------------- Aurelius	0-8 8-24 24-60	--- --- 0-35	0.32-0.52 --- 1.56-1.89	0.2-6.0 --- 0.6-2.0	0.35-0.45 --- 0.18-0.24	6.6-8.4 7.4-8.4 7.4-8.4	-------------- -------------- Low-----------	---- ---- ----	---	2	40-60
36A-------------- Pipestone	0-10 10-36 36-60	2-12 2-12 2-12	0.63-1.57 1.22-1.57 1.22-1.57	6.0-20 6.0-20 >20	0.07-0.10 0.06-0.09 0.05-0.07	4.5-7.3 4.5-7.3 5.1-7.3	Low----------- Low----------- Low-----------	0.17 0.17 0.17	5	1	3-4
38A-------------- Mitiwanga	0-12 12-23 23	12-20 24-30 ---	1.29-1.72 1.40-1.83 ---	0.6-2.0 0.6-2.0 ---	0.17-0.21 0.13-0.17 ---	4.5-6.5 4.5-5.5 ---	Low----------- Moderate----- --------------	0.32 0.32 ----	4	6	---
39A-------------- Rapson	0-25 25-60	2-15 10-20	1.29-1.72 1.40-1.94	6.0-20 0.6-2.0	0.06-0.12 0.05-0.20	5.6-7.8 7.9-8.4	Low----------- Low-----------	0.17 0.43	5	2	2-3
40A-------------- Wasepi	0-13 13-26 26-45 45-60	2-10 10-22 0-10 20-35	1.25-1.41 1.35-1.45 1.25-1.50 1.46-1.95	6.0-20 2.0-6.0 >20 0.2-0.6	0.08-0.12 0.08-0.17 0.02-0.04 0.11-0.20	6.1-7.8 6.6-7.8 7.4-8.4 7.9-8.4	Low----------- Low----------- Low----------- Moderate-----	0.20 0.20 0.10 0.37	4	2	1-3

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
42A-------------- Tyre	0-5	5-12	0.63-1.57	2.0-6.0	0.08-0.12	5.1-7.3	Low----------	0.17	4	2	2-7
	5-25	2-10	1.22-1.57	6.0-20	0.02-0.08	6.1-7.3	Low----------	0.17			
	25	---	---	---	---	---	-------------	----			
43--------------- Tobico	0-8	2-10	0.92-1.59	6.0-20	0.06-0.20	6.6-7.8	Low----------	0.15	5	2	4-6
	8-60	0-10	1.45-1.74	>20	0.04-0.07	7.4-8.4	Low----------	0.15			
44A-------------- Badaxe	0-7	12-18	1.43-1.73	2.0-6.0	0.06-0.12	6.1-7.3	Low----------	0.24	4	8	1-3
	7-12	12-18	1.44-1.81	0.6-2.0	0.09-0.14	7.4-7.8	Low----------	0.24			
	12-34	12-18	1.44-1.81	0.6-2.0	0.10-0.18	7.4-7.8	Low----------	0.24			
	34-60	12-30	1.70-2.13	<0.06	0.03-0.05	7.9-8.4	Low----------	0.37			
45--------------- Granby	0-11	2-14	0.92-1.59	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	4-6
	11-60	0-14	1.45-1.74	6.0-20	0.05-0.12	5.6-7.8	Low----------	0.17			
	32-60	0-10	1.45-1.74	6.0-20	0.05-0.09	6.6-8.4	Low----------	0.17			
46--------------- Linwood	0-25	0	0.13-0.40	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	---	3	42-65
	25-60	0-35	1.80-1.97	0.6-2.0	0.16-0.20	5.6-8.4	Low----------	----			
49B*:											
Grindstone------	0-9	8-20	1.31-1.78	0.6-2.0	0.10-0.22	6.6-7.8	Low----------	0.32	4	5	1-3
	9-27	18-35	1.31-1.86	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	27-60	12-28	1.70-2.13	<0.06	0.04-0.08	7.9-8.4	Low----------	0.32			
Kilmanagh-------	0-9	15-22	1.12-1.59	0.6-2.0	0.16-0.20	6.6-7.8	Low----------	0.32	4	5	1-3
	9-29	18-30	1.48-1.80	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	29-44	18-30	1.48-1.80	0.2-2.0	0.10-0.18	7.4-8.4	Low----------	0.32			
	44-60	14-28	1.70-2.13	<0.06	0.05-0.09	7.4-8.4	Low----------	0.32			
50A*:											
Shebeon---------	0-11	5-20	1.43-1.73	2.0-6.0	0.08-0.15	6.6-7.8	Low----------	0.24	4	3	1-3
	11-23	18-30	1.44-1.81	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	23-33	18-32	1.44-1.81	0.2-2.0	0.08-0.19	7.4-8.4	Low----------	0.32			
	33-60	8-18	1.70-2.13	<0.06	0.04-0.08	7.4-8.4	Low----------	0.32			
Badaxe----------	0-10	12-18	1.43-1.73	2.0-6.0	0.10-0.18	6.1-7.3	Low----------	0.24	4	3	1-3
	10-15	12-18	1.44-1.81	0.6-2.0	0.09-0.14	7.4-7.8	Low----------	0.24			
	15-27	12-18	1.44-1.81	0.6-2.0	0.10-0.18	7.4-7.8	Low----------	0.24			
	27-60	12-30	1.70-2.13	<0.06	0.03-0.05	7.9-8.4	Low----------	0.37			
51B*:											
Guelph----------	0-9	12-25	1.31-1.78	0.6-2.0	0.14-0.20	6.1-7.8	Low----------	0.32	5	5	1-3
	9-21	18-35	1.31-1.86	0.6-2.0	0.14-0.18	6.1-7.8	Low----------	0.32			
	21-60	18-32	1.33-1.89	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.32			
Londo-----------	0-9	10-18	1.43-1.73	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	5	6	1-3
	9-20	27-35	1.44-1.81	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	20-60	20-32	1.47-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
51C, 51D--------- Guelph	0-9	12-25	1.31-1.78	0.6-2.0	0.14-0.20	6.1-7.8	Low----------	0.32	5	5	1-3
	9-21	18-35	1.31-1.86	0.6-2.0	0.14-0.18	6.1-7.8	Low----------	0.32			
	21-60	18-32	1.33-1.89	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.32			
53B-------------- Shebeon	0-9	5-24	1.43-1.73	0.6-6.0	0.05-0.18	6.6-7.8	Low----------	0.24	4	8	1-3
	9-25	18-30	1.44-1.81	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	25-37	18-32	1.44-1.81	0.2-2.0	0.08-0.19	7.4-8.4	Low----------	0.32			
	37-60	8-18	1.70-2.13	<0.06	0.04-0.08	7.4-8.4	Low----------	0.32			
54B-------------- Grindstone	0-7	8-20	1.31-1.78	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32	4	5	1-3
	7-36	18-35	1.31-1.86	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	36-60	12-28	1.70-2.13	<0.06	0.04-0.08	7.9-8.4	Low----------	0.32			
55--------------- Kilmanagh	0-9	15-22	1.12-1.59	0.6-2.0	0.12-0.18	6.6-7.8	Low----------	0.24	4	8	1-3
	9-34	18-30	1.48-1.80	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	34-43	18-30	1.48-1.80	0.2-2.0	0.10-0.18	7.4-8.4	Low----------	0.32			
	43-60	14-28	1.70-2.13	<0.06	0.05-0.09	7.4-8.4	Low----------	0.32			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
56A*:											
Riverdale	0-9	2-10	1.25-1.41	6.0-20	0.06-0.12	6.1-7.8	Low	0.17	4	2	1-4
	9-21	2-12	1.35-1.45	6.0-20	0.05-0.11	6.1-7.8	Low	0.17			
	21-25	5-15	1.35-1.45	2.0-6.0	0.05-0.13	6.1-7.8	Low	0.17			
	25-60	0-5	1.25-1.50	>20	0.02-0.04	7.9-8.4	Low	0.10			
Pipestone	0-10	2-12	0.63-1.57	6.0-20	0.07-0.10	4.5-7.3	Low	0.17	5	1	3-4
	10-36	2-12	1.22-1.57	6.0-20	0.06-0.09	4.5-7.3	Low	0.17			
	36-60	2-12	1.22-1.57	>20	0.05-0.07	5.1-7.3	Low	0.17			
57A Londo	0-9	10-18	1.43-1.73	0.6-2.0	0.18-0.24	6.1-7.8	Low	0.32	5	6	1-3
	9-20	27-35	1.44-1.81	0.2-2.0	0.14-0.19	6.6-7.8	Moderate	0.32			
	20-60	20-32	1.47-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate	0.32			
58 Parkhill	0-9	10-20	1.12-1.59	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.28	5	5	1-4
	9-32	18-35	1.48-1.80	0.2-0.6	0.15-0.19	6.1-7.8	Low	0.28			
	32-60	12-25	1.46-1.95	0.6-2.0	0.17-0.19	7.4-8.4	Low	0.28			
60 Pinnebog	0-34	---	0.30-0.40	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	---	2	40-80
	34-50	---	0.10-0.25	0.6-6.0	0.45-0.55	5.6-7.8	-------------	----			
	50-60	---	0.10-0.25	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----			
62 Essexville	0-12	10-15	1.35-1.50	6.0-20	0.10-0.14	7.4-8.4	Low	0.17	5	2	4-8
	12-22	2-12	1.40-1.55	6.0-20	0.04-0.12	7.9-8.4	Low	0.17			
	22-60	10-35	1.46-1.95	0.2-0.6	0.12-0.20	7.9-8.4	Moderate	0.32			
63*. Pits											
64*. Udipsamments											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[The descriptions of "flooding" and "water table" in the text explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
3A---------------- Shebeon	C	None---------	---	---	1.0-2.0	Perched	Dec-May	>60	---	High-----	High-----	Low.
4B---------------- Grindstone	C	None---------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	High-----	Moderate	Low.
5----------------- Kilmanagh	C	Frequent----	Brief-----	Jan-May	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
6A---------------- Avoca	A	None---------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	Moderate	High-----	Low.
7A, 7B------------ Aubarque	C/D	None---------	---	---	0.5-1.5	Perched	Dec-May	>60	---	High-----	High-----	Low.
9B, 9C------------ Plainfield	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	High.
11A--------------- Covert	A	None---------	---	---	1.5-3.5	Apparent	Nov-May	>60	---	Low------	Low------	Moderate.
12A--------------- Sanilac	B	None---------	---	---	1.0-2.0	Apparent	Oct-Jun	>60	---	High-----	Moderate	Low.
13B--------------- Gagetown	B	None---------	---	---	2.0-3.0	Apparent	Dec-Mar	>60	---	High-----	Moderate	Low.
14A--------------- Badaxe	B	None---------	---	---	1.0-2.0	Apparent	Dec-Apr	>60	---	High-----	High-----	Low.
15B--------------- Deerton Variant	B	None---------	---	---	1.5-3.5	Perched	Dec-Apr	20-40	Hard	Low------	Low------	High.
18---------------- Tappan	B/D	Frequent----	Brief-----	Jan-May	0-1.0	Apparent	Oct-May	>60	---	High-----	High-----	Low.
19---------------- Corunna	B/D	Frequent----	Brief-----	Mar-May	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
20A--------------- Covert	A	None---------	---	---	1.5-3.5	Apparent	Nov-Apr	>60	---	Low------	Low------	Moderate.
23*. Fluvaquents												
24*: Aquents.												
Histosols.												

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
26B, 26C---------- Boyer	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
27--------------- Filion	D	Frequent----	Brief-----	Nov-May	0-1.0	Perched	Oct-Jun	>60	---	High-----	High-----	Low.
28B*:												
Covert-----------	A	None--------	---	---	1.5-3.5	Apparent	Nov-Apr	>60	---	Low------	Low------	Moderate.
Tobico-----------	A/D	Frequent----	Brief-----	Sep-May	0-1.0	Apparent	Sep-Jun	>60	---	Moderate	High-----	Low.
29A*:												
Pipestone--------	A	None--------	---	---	0.5-1.5	Apparent	Oct-Jun	>60	---	Moderate	Low------	Moderate.
Tobico-----------	A/D	Frequent----	Brief-----	Sep-May	0-1.0	Apparent	Sep-Jun	>60	---	Moderate	High-----	Low.
Adrian-----------	A/D	Frequent----	Long------	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
30--------------- Bach	B/D	Frequent----	Long------	Oct-May	0-1.0	Apparent	Sep-Jun	>60	---	High-----	High-----	Low.
31--------------- Belleville	B/D	Frequent----	Brief-----	Mar-Apr	0-1.0	Apparent	Mar-May	>60	---	High-----	High-----	Low.
32C*:												
Plainfield-------	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	High.
Covert-----------	A	None--------	---	---	1.5-3.5	Apparent	Nov-Apr	>60	---	Low------	Low------	Moderate.
34--------------- Aurelius	B/D	Frequent----	Long------	Sep-May	0-0.5	Apparent	Sep-Jun	>60	---	High-----	High-----	Low.
36A-------------- Pipestone	A	None--------	---	---	0.5-1.5	Apparent	Oct-Jun	>60	---	Moderate	Low------	Moderate.
38A-------------- Mitiwanga	C	None--------	---	---	1.0-2.5	Perched	Nov-Jun	20-40	Hard	High-----	High-----	Moderate.
39A-------------- Rapson	B	None--------	---	---	1.0-2.0	Apparent	Dec-May	>60	---	Moderate	Low------	High.
40A-------------- Wasepi	B	None--------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	High-----	Low------	Low.
42A-------------- Tyre	A/D	Frequent----	Brief-----	Dec-Apr	1.0-1.5	Apparent	Dec-Apr	20-40	Rippable	Moderate	Moderate	Moderate.
43--------------- Tobico	A/D	Frequent----	Brief-----	Sep-May	0-1.0	Apparent	Sep-Jun	>60	---	Moderate	High-----	Low.
44A-------------- Badaxe	B	None--------	---	---	1.0-2.0	Apparent	Dec-Apr	>60	---	High-----	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
45---------------- Granby	A/D	Frequent----	Brief-----	Mar-Apr	0-1.0	Apparent	Nov-Jun	>60	---	Moderate	High-----	Low.
46---------------- Linwood	A/D	Frequent----	Long------	Nov-Jun	0-1.0	Apparent	Nov-Jun	>60	---	High-----	Moderate	Low.
49B*:												
Grindstone-------	C	None--------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	High-----	Moderate	Low.
Kilmanagh--------	C	Frequent----	Brief-----	Jan-May	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
50A*:												
Shebeon----------	C	None--------	---	---	1.0-2.0	Perched	Dec-May	>60	---	High-----	High-----	Low.
Badaxe-----------	B	None--------	---	---	1.0-2.0	Apparent	Dec-Apr	>60	---	High-----	High-----	Low.
51B*:												
Guelph-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Londo------------	C	None--------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
51C, 51D---------- Guelph	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
53B--------------- Shebeon	C	None--------	---	---	1.0-2.0	Perched	Dec-May	>60	---	High-----	High-----	Low.
54B--------------- Grindstone	C	None--------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	High-----	Moderate	Low.
55---------------- Kilmanagh	C	Frequent----	Brief-----	Jan-May	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
56A*:												
Riverdale--------	A	None--------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	Moderate	Low------	Low.
Pipestone--------	A	None--------	---	---	0.5-1.5	Apparent	Oct-Jun	>60	---	Moderate	Low------	Moderate.
57A--------------- Londo	C	None--------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
58---------------- Parkhill	B/D	Frequent----	Brief-----	Mar-Apr	0-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
60---------------- Pinnebog	A/D	Frequent----	Long------	Nov-Jun	0-1.0	Apparent	Oct-Jul	>60	---	High-----	Moderate	Moderate.
62---------------- Essexville	A/D	Occasional	Brief-----	Nov-Jun	0-1.5	Apparent	Nov-May	>60	---	High-----	High-----	Low.
63*. Pits												

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
64*. Udipsamments												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Aquents	Mixed, nonacid, mesic Aquepts
Aubarque	Coarse-loamy, mixed (calcareous), mesic Aeric Haplaquepts
Aurelius	Fine-silty, carbonatic, mesic Histic Humaquepts
Avoca	Sandy over loamy, mixed, mesic Entic Haplaquods
*Bach	Coarse-silty, mixed (calcareous), mesic Mollic Haplaquepts
Badaxe	Coarse-loamy, mixed, mesic Aquic Hapludalfs
Belleville	Sandy over loamy, mixed, mesic Typic Haplaquolls
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Corunna	Coarse-loamy, mixed, mesic Typic Haplaquolls
Covert	Sandy, mixed, mesic Entic Haplorthods
Deerton Variant	Sandy-skeletal mixed, mesic Entic Haplorthods
Essexville	Sandy over loamy, mixed (calcareous), mesic Typic Haplaquolls
Filion	Fine-loamy, mixed (calcareous), mesic Typic Haplaquepts
Fluvaquents	Loamy, mixed, nonacid, mesic Fluvaquents
Gagetown	Coarse-silty, mixed, mesic Typic Hapludolls
Granby	Sandy, mixed, mesic Typic Haplaquolls
Grindstone	Fine-loamy, mixed, mesic Glossaquic Hapludalfs
Guelph	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Histosols	Euic, mesic Histosols
Kilmanagh	Fine-loamy, mixed, nonacid, mesic Aeric Haplaquepts
Linwood	Loamy, mixed, euic, mesic Terric Medisaprists
*Londo	Fine-loamy, mixed, mesic Aeric Glossaqualfs
Mitiwanga	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Parkhill	Fine-loamy, mixed, nonacid, mesic Mollic Haplaquepts
Pinnebog	Euic, mesic Hemic Medisaprists
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Plainfield	Mixed, mesic Typic Udipsamments
Rapson	Sandy over loamy, mixed, mesic Entic Haplaquods
Riverdale	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Sanilac	Coarse-silty, mixed (calcareous), mesic Aeric Haplaquepts
Shebeon	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Tappan	Fine-loamy, mixed (calcareous), mesic Typic Haplaquolls
Tobico	Mixed, mesic Mollic Psammaquents
Tyre	Mixed, mesic Typic Psammaquents
Udipsamments	Mixed, mesic Udipsamments
Wasepi	Coarse-loamy, mixed, mesic Aquollic Hapludalfs

TABLE 19.--AVERAGE COMPOSITION OF SELECTED MAP UNITS AS DETERMINED BY THE POINT-INTERCEPT TRANSECT METHOD

Map symbol and soil name	Observation number	Named and similar series		Somewhat contrasting series		Strongly contrasting series	
		Series	Percent	Series	Percent	Series	Percent
3A, Shebeon loam, 0 to 3 percent slopes.	280	Shebeon Similar series[1]	34 25	Kilmanagh Aubarque Sanilac Other	16 6 6 7	Avoca Other	3 3
4B, Grindstone loam, 0 to 4 percent slopes.	93	Grindstone	73	Shebeon Gagetown Other	10 7 4	Avoca Other	3 3
5, Kilmanagh loam	258	Kilmanagh	69	Shebeon Tappan Other	13 7 6	Badaxe Other	2 3
6A, Avoca loamy sand, 0 to 2 percent slopes.	100	Avoca	52	Badaxe Sanilac Belleville Other	8 4 3 7	Shebeon Kilmanagh Other	9 7 6
7A, Aubarque loam, 0 to 2 percent slopes.	90	Aubarque	54	Shebeon Kilmanagh Grindstone Other	20 7 6 9	Avoca	4
12A, Sanilac silt loam, 0 to 3 percent slopes.	88	Sanilac	53	Shebeon Gagetown Badaxe Other	20 7 4 5	Avoca Other	4 7
13B, Gagetown silt loam, 0 to 4 percent slopes.	46	Gagetown	69	Grindstone Sanilac	20 2	Avoca	9
14A, Badaxe fine sandy loam, 0 to 3 percent slopes.	51	Badaxe	47	Shebeon Avoca Other	22 22 3	Kilmanagh Other	4 2
18, Tappan loam	49	Tappan	84	Kilmanagh Shebeon	10 4	Avoca	2
30, Bach silt loam	58	Bach Similar series[2]	48 33	Kilmanagh Sanilac	14 5		
40A, Wasepi, loamy substratum, 0 to 2 percent slopes.	31	Wasepi loamy substratum. Avoca Avoca[3]	29 16 19	Pipestone Other	20 9	Shebeon	7
49B, Grindstone-Kilmanagh loams, 0 to 4 percent slopes.	36	Grindstone Kilmanagh	55 24	Shebeon Other	11 6	Other	3
50A, Shebeon-Badaxe sandy loam, 0 to 2 percent slopes.	112	Shebeon Badaxe	38 25	Avoca Kilmanagh Sanilac Other	13 7 5 7	Other	5

See footnotes at end of table.

TABLE 19.--AVERAGE COMPOSITION OF SELECTED MAP UNITS AS DETERMINED BY THE POINT-INTERCEPT TRANSECT METHOD

Map symbol and soil name	Observation number	Named and similar series		Somewhat contrasting series		Strongly contrasting series	
		Series	Percent	Series	Percent	Series	Percent
51B, Guelph-Londo loams, 2 to 6 percent slopes.	115	Guelph Londo	48 40	Parkhill Other	3 5	Other	4
53B, Shebeon cobbly loam, 0 to 4 percent slopes.	47	Shebeon cobbly Similar series[1]	34 40	Aubarque, cobbly Badaxe, cobbly Other	7 11 4	Avoca	4
56A, Riverdale-Pipestone complex, 0 to 2 percent slopes.	69	Riverdale Wasepi Pipestone	43 15 25	Rapson	11	Londo Tobico	3 3

[1]Similar to Shebeon soil, but no argillic horizon was discernable by field observations.

[2]Similar to Bach soil, but noncalcareous.

[3]Similar to Avoca soil, but depth to glacial till is more than 40 inches.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1979 O—298-860

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.