SOIL SURVEY OF

Williams County, Ohio

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Ohio Department of Natural Resources
Division of Lands and Soil and
Ohio Agricultural Research and Development Center

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

Major fieldwork for this soil survey was completed in the period 1967–72. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Williams Soil and Water Conservation District.

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

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the management of soils for crops and pasture.

Foresters and others can refer to the section "Woodland Management and Productivity" where the woodland in the county is discussed and the potential productivity of selected soils is given.

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

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the sections "Engineering" and "Recreation."

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

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

Newcomers in Williams County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "General Nature of the County."

Cover: **Recently planted field on lake plains. The light colored Haskins soil in the foreground and the darker colored, lower lying Hoytville soil are productive of most crops grown in the county.**

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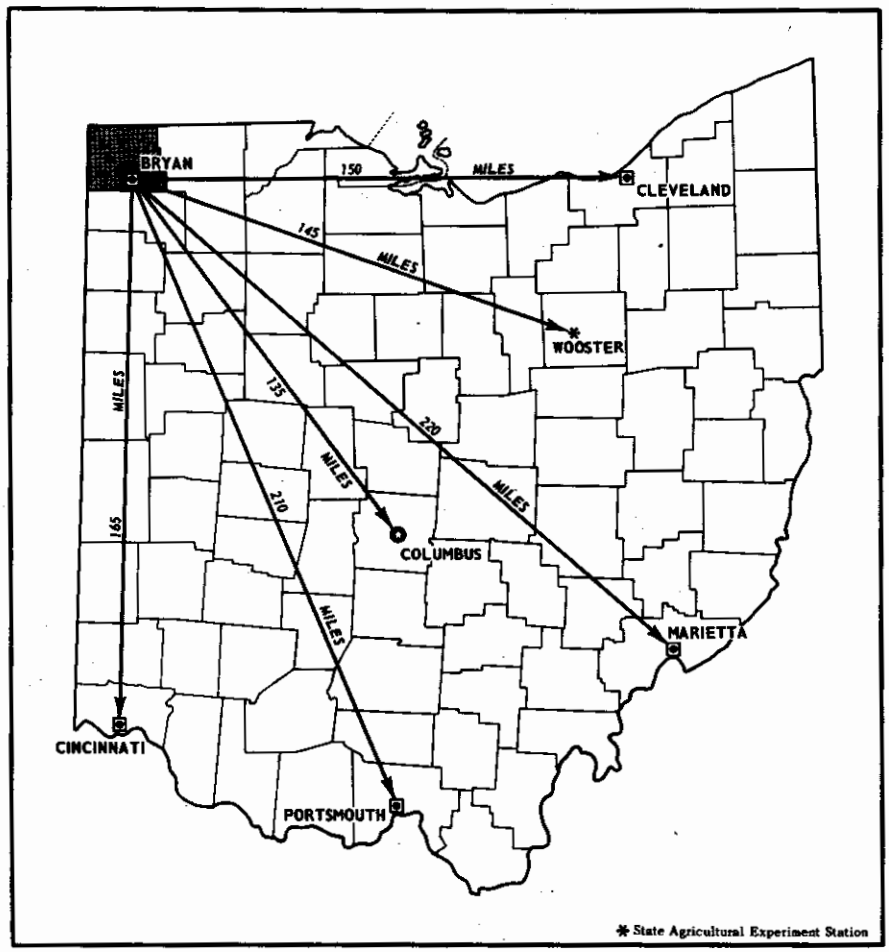

Location of Williams County in Ohio.

SOIL SURVEY OF WILLIAMS COUNTY, OHIO

By Kenneth L. Stone, Jr., E. Cecil Flesher, Donald R. Urban, Jonathan C. Gerken, Paul C. Jenny, and Gene W. Borton, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center

WILLIAMS COUNTY is in the northwest corner of Ohio (see facing page). It has a total area of 421 square miles, or 269,312 acres. It is bounded on the north by Hillsdale County, Mich., on the west by Steuben and Dekalb Counties, Ind., on the south by Defiance County, and on the east by Fulton and Henry Counties.

In 1970 the total population of the county was 33,669. Bryan, the county seat and only city, which is in the south central part, had a population of 7,008. Villages in Williams County are Alvordton, Blakeslee, Edgerton, Edon, Montpelier, Pioneer, Stryker, and West Unity.

Williams County lies entirely within the Wisconsin glaciated part of Ohio. Two prominent glacial moraines, the Wabash and Fort Wayne, cross the county in a northeast-southwest direction, and two extensive glacial till plains border the Fort Wayne Moraine on either side. Southeastern Williams County makes up part of the glacial lake plain of northwestern Ohio. The morainic areas are nearly level to moderately steep in the glacial till plains and are mostly level to gently sloping in the lake plain.

All of the county is within the Maumee River watershed. The two major waterways are the St. Joseph and Tiffin Rivers. The St. Joseph River bisects the county in a northeast-southwest direction. The Tiffin River cuts across the southeast corner of Williams County as it enters from Fulton County and flows south into Defiance County.

The large areas of deep, fertile, level to gently sloping soil have made Williams County well suited to farming. Corn, soybeans, wheat, and hay are the major crops. A considerable part of the annual farm income is derived from the sale of livestock and livestock products. Nonfarm development, particularly residential, has increased in Williams County in recent years.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. 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, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has been changed very little by leaching or by the action of plants roots.

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

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Soil series commonly are named for towns or other geographic features near the place where they were first observed and mapped. Ottokee and Toledo, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in characteristics.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Blount loam, 2 to 6 percent slopes, is one of several phases within the Blount series.

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

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

Some map units are made up of soils of different series, or of different phases within one series, and some have little or no soil. These kinds of mapping units are discussed in the section "Descriptions of the Soils."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. Existing ratings of suitabilities and limitations (interpretations) of the soils are field tested and modified as necessary during the course of the survey, and new interpretations are added to meet local needs. This is done mainly through field observations of behavior of different kinds of soil for different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and other information available from State and local specialists. For example, data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

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 is readily useful to different groups of users, among them farmers, managers of woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation. Presenting the detailed information in an organized, understandable manner is the purpose of this publication.

General Soil Map

The general soil map at the back of this publication shows, in color, the soil associations described in this survey. Each soil association is a unique natural landscape unit that has a distinctive pattern of soils and relief and drainage features. It normally consists of one or more soils of major extent and some soils of minor extent, and it is named for the major soils. The kinds of soil in one association may occur in other soil associations, but in a different pattern.

The map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas of the county for general kinds of land use. From the map, areas that are generally suitable for certain kinds of farming or other land uses can be identified. Likewise, areas with soil properties distinctly unfavorable for certain land uses can be located.

Because of the small scale of the map, it does not show the kind of soil at a specific site. Thus, this is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure because the kinds of soils in any one soil association ordinarily differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The twelve soil associations in this survey have been grouped into two general kinds of landscapes for broad interpretive purposes. Each of the broad groups and the soil associations in it are described in the following pages.

Soils That Formed Mainly in Water Deposited or Water Reworked Material

The soils that make up these associations are in the southeastern third of the county. They formed mainly in water-deposited material or in wave-modified glacial till. The material ranges from sand to clay. Most soils are level to gently sloping.

1. *Roselms-Paulding association*

Nearly level to gently sloping, somewhat poorly drained and very poorly drained soils that have a heavy clayey subsoil; on broad flats on the lake plain

This association occupies the broad, flat lake plain area in the southeastern corner of the county. These soils are mostly nearly level to gently sloping. More sloping areas occur along the sides of stream valleys that dissect the association.

This association makes up about 1 percent of the county. It is about 56 percent Roselms soils, 26 percent Paulding soils, and 18 percent soils of minor extent.

Roselms and Paulding soils formed in limy clay material deposited in a former glacial lake. The dominant Roselms soils are somewhat poorly drained and nearly level to gently sloping. Paulding soils are very poorly drained and more grayish colored than Roselms soils. These nearly level soils are on flats and in shallow drainageways.

Minor in this association are the somewhat poorly drained Haskins and Rimer soils, the very poorly drained Bono soils, and the moderately well drained Seward soils.

Waterlogging for long periods during the year, which is the result of a seasonal high water table and the clayey, very slowly permeable subsoil, is a severe limitation for Roselms and Paulding soils for farming. Ponding is common on Paulding soils during wet periods unless adequate drainage is provided. Very slow permeability, in addition to wetness, severely limits Roselms and Paulding soils for many nonfarm uses.

Soybeans and small grain are the major crops, but an increasing acreage is being used for corn.

2. *Latty-Fulton association*

Nearly level to gently sloping, very poorly drained and somewhat poorly drained soils that have a clayey subsoil; on broad flats on the lake plain

This association consists of three areas concentrated in southeastern Williams County. The soils in this association are mainly nearly level to gently sloping. Some more sloping areas occupy the sides of stream valleys and major drainageways.

This association makes up about 7 percent of the county. It is about 40 percent Latty soils, 38 percent Fulton soils, and 22 percent soils of minor extent.

Latty and Fulton soils formed in limy silty clay material deposited in a former glacial lake. Latty soils are very poorly drained and are nearly level. They are on broad flats. The Fulton soils are somewhat poorly drained and nearly level to gently sloping. They occupy low rises.

Minor in the association are the moderately well drained and more sloping Lucas soils and the somewhat poorly drained Haskins soils. Also included are

Figure 1.—Typical landscape of Latty-Fulton soil association. These soils have a clayey subsoil. Wetness is a severe hazard in farming.

small sandy spots of Rimer and Seward soils and small areas of Shoals and Sloan soils on narrow flood plains.

Wetness from a seasonal high water table and slow to very slow permeability in the subsoil are the major limitations of Latty and Fulton soils for farming (fig. 1). Ponding is common on Latty soils during wet periods unless adequate drainage is provided. Very slow to slow permeability, in addition to wetness, severely limits Latty and Fulton soils for many nonfarm uses.

When adequately drained and well managed, this association is one of the most productive in the county for farming. Corn, soybeans, and small grain are the major crops.

3. *Del Rey-Lenawee association*

Nearly level to gently sloping, somewhat poorly drained to very poorly drained soils that have a silty and clayey subsoil; on broad flats on the lake plain

This soil association consists of two areas in the southeastern part of the county near Stryker. The soils are mainly nearly level to gently sloping, but some more sloping areas occur along the sides of major drainageways.

This association makes up about 6 percent of the county. It is about 45 percent Del Rey soils, 27 percent Lenawee soils, and 28 percent soils of minor extent.

Del Rey and Lenawee soils formed in silty clay loam and silt loam material deposited in a former glacial lake. The dominant Del Rey soils are somewhat poorly drained and lighter colored than Lenawee soils. These nearly level and gently sloping soils are on low rises. Lenawee soils are very poorly drained and nearly level. They occupy broad flats and shallow depressions.

Minor soils in this association are the sloping, moderately well drained Shinrock soils, the somewhat poorly drained Kibbie and Rimer soils, and the moderately well drained Seward soils.

Wetness from a seasonal high water table and moderately slow to slow permeability in the subsoil severely limit these soils for farming. Ponding commonly occurs on Lenawee soils during wet periods unless adequate drainage is provided. The moderately slow to slow permeability, in addition to the wetness hazard, is a severe limitation of the major soils for many nonfarm uses.

Under good management, including adequate drainage, Del Rey and Lenawee soils are moderately to highly productive for farming. Corn and soybeans are the major crops.

4. *Nappanee-Hoytville association*

Nearly level to gently sloping, somewhat poorly drained and very poorly drained soils that have a

clayey subsoil; on broad, wave modified flats on the lake plain

This association consists of two comparatively small areas. One area is in and around Bryan, the county seat, and the other is northeast of West Unity along the Fulton County line.

This association makes up about 2 percent of the county. It is about 45 percent Nappanee soils, 38 percent Hoytville soils, and 17 percent soils of minor extent.

Nappanee and Hoytville soils formed in limy, fine textured glacial till that has been modified by wave action of a post-glacial lake. The somewhat poorly drained Nappanee soils are nearly level to gently sloping. Hoytville soils are very poorly drained and nearly level. They are on broad flats and in drainageways. Minor in this assocation are the very poorly drained Mermill soils and the somewhat poorly drained Haskins soils.

Wetness caused by a seasonal high water table and slow to very slow permeability in the subsoil severely limit the Nappanee and Hoytville soils for farming. Ponding commonly occurs on Hoytville soils during wet periods unless adequate drainage is provided. Slow to very slow permeability, in addition to wetness, is a severe limitation of the major soils for many nonfarm uses.

This association is one of the most productive in the county for farming when the soils are adequately drained and well managed. Corn and soybeans are the major crops.

5. *Eel-Genesee-Sloan association*

Nearly level, moderately well drained, well drained and very poorly drained soils that have a loamy subsoil; on flood plains

This association is along the Tiffin River and its major tributaries in southeastern Williams County. It makes up flood plain areas which are long but only one-eighth to one-half mile wide. All the major soils formed in sediments that were washed or eroded from the surrounding uplands.

This association makes up about 1 percent of the county. It is about 35 percent Eel soils, 30 percent Genesee soils, 20 percent Sloan soils, and 15 percent soils of minor extent.

The moderately well drained Eel soils and the well drained Genesee soils occupy long narrow strips along streams. The very poorly drained Sloan soils typically occupy slight depressional areas and shallow drainageways on the flood plain.

Minor in this association are the somewhat poorly drained Shoals soils on flood plains and the somewhat poorly drained Digby soils and very poorly drained Millgrove soils on low, gravelly terraces.

Seasonal flooding that results in sediment deposition, streambank erosion, and ponding is a severe limitation of this association for some farm and most nonfarm uses. Wetness and ponding after heavy rains and flooding also limit Sloan soils. The soils in this association are productive for farming, but the hazard of flooding after planting tends to lower crop yields. Small grain crops are not commonly grown because of possible damage by spring flooding.

Corn and soybeans are the major crops. Some frequently flooded areas of the association are used for permanent pasture.

6. *Millgrove-Mermill-Haskins association*

Nearly level, very poorly drained and somewhat poorly drained soils that have a loamy and clayey subsoil; on broad flats on uplands

This association occupies two areas in the southeastern part of the county. One of these areas is south of Bryan, and the other extends in a northeast direction from Bryan to West Unity.

This association makes up about 5 percent of the county. It is about 30 percent Millgrove soils, 30 percent Mermill soils, 20 percent Haskins soils, and 20 percent soils of minor extent.

The Millgrove and Mermill soils are nearly level, dark colored, and very poorly drained. The Haskins soils are nearly level and somewhat poorly drained. The dominant Millgrove soils formed in loamy outwash material and in the underlying sand and gravelly deposits, which contain some finer textured sediments. Mermill and Haskins soils formed in loamy materials and in the underlying clayey glacial till. Both Millgrove and Mermill soils are on broad flats and in drainageways. The Haskins soils are mainly on broad flats.

Minor soils include the very poorly drained Gilford and Toledo soils and the somewhat poorly drained Digby soils.

Wetness from a seasonal high water table is a severe limitation of these soils for farming. Ponding commonly occurs on Millgrove and Mermill soils during wet seasons unless adequate drainage is provided. Wetness severely limits the soils for many nonfarm uses.

If well managed and adequately drained, this association is the most productive in the county for farming. Corn, soybeans, and wheat are the major crops. With more intensive drainage systems, this association is potentially suited to truck and specialty crops.

7. *Haskins-Haney-Rawson association*

Nearly level to sloping, somewhat poorly drained and moderately well drained soils that have a loamy and clayey subsoil; on beach ridges

This association occurs as a long narrow area that extends in a northeast to southwest direction across the eastern part of the county. It makes up the beach ridge, which was the shore line of a former glacial lake.

This association makes up about 3 percent of the county. It is about 34 percent Haskins soils, 22 percent Haney soils, 20 percent Rawson soils, and 24 percent soils of minor extent.

The dominant Haskins soils are nearly level, somewhat poorly drained soils that formed in loamy materials and in the underlying clayey glacial till. Haney soils are nearly level to sloping, moderately well drained soils that formed in loamy material and in the underlying gravelly and sandy material. Rawson soils are gently sloping to sloping, moderately well drained soils that formed in loamy materials and in the underlying loamy to clayey glacial till.

Among the minor soils in this association are the well drained Belmore, Oshtemo, and Arkport soils and the very poorly drained Mermill soils. Arkport soils occur just east and slightly south of West Unity.

Wetness on Haskins soils is caused by a seasonal high water table and is a major limitation for farming. Because of generally good natural drainage, Haney and Rawson soils normally do not require artificial drainage. The soils in this association are characterized by a moderate to high sand content. Droughtiness can occur in particularly dry seasons.

If well managed, these soils are moderately productive. They are used mainly for corn, soybeans, and small grain. Some provide some of the best building sites in Williams County because natural drainage is good and slopes are mostly gentle.

Soils That Formed Mainly in Glacial Till or Glacial Outwash

The soils that make up these associations are in the northwestern two-thirds of the county. They formed in glacial till or sandy and gravelly outwash. They occupy the more rolling part of the county.

8. *Blount-Oshtemo-Sloan association*

Nearly level to sloping, somewhat poorly drained, well drained and very poorly drained soils that have a sandy to clayey subsoil; on terraces and flood plains

The largest of two areas that make up this association occupies a continuous strip along the St. Joseph River. It bisects the county in a northeast to southwest direction. The other small area is just east of Alvordton in the northeast corner of the county.

This association makes up about 6 percent of the county. It is about 32 percent Blount soils, 20 percent Oshtemo soils, 15 percent Sloan soils, and 33 percent soils of minor extent.

Blount soils are nearly level to gently sloping and somewhat poorly drained. They formed in loamy glacial till. They occupy upland areas adjacent to the stream valleys. The gently sloping to sloping, well drained Oshtemo soils formed in sandy and loamy material and the underlying sandy and gravelly deposits. They occupy broad areas on terraces. Sloan soils are very poorly drained and nearly level. They are on flood plains.

Among the minor soils are the very poorly drained Pewamo soils and moderately well drained Glynwood soils on uplands; the well drained Boyer soils and the somewhat poorly drained Digby soils on terraces; the somewhat poorly drained Shoals soils and the well drained to moderately well drained Landes soils, all of which are on flood plains.

Wetness and slow permeability on Blount soils and flooding on Sloan soils are severe limitations for farming. Seasonal droughtiness and some soil blowing are limitations on the sandy Oshtemo soils. In places where slope is not a limitation, these well drained soils provide some of the best building sites in the county.

Corn, soybeans, and small grain are the major crops. Although available water capacity is low in the sandy Oshtemo soils, these soils can be irrigated. Sloan soils are productive for farming, but occasional flooding after planting lowers the average crop yield.

9. *Blount-Glynwood association*

Nearly level to steep, somewhat poorly drained and moderately well drained soils that have a clayey and loamy subsoil; on uplands

This association is the largest in the county. It occurs as a broad belt several miles wide extending from the northeast to the southwest. It is made up of upland soils formed in loamy glacial till. Most areas are nearly level to sloping. Some of the more sloping areas occupy the sides of stream valleys and major drainageways.

This association makes up about 36 percent of the county. It is about 50 percent Blount soils, 18 percent Glynwood soils and 32 percent soils of minor extent.

Blount soils are somewhat poorly drained and are nearly level to gently sloping. The moderately well drained Glynwood soils are mainly gently sloping to sloping, but they are more sloping on the sides of stream valleys.

Minor in this association are the very poorly drained Pewamo soils in shallow drainageways. Other minor soils include the very poorly drained Bono, Mermill, and Carlisle soils and the somewhat poorly drained Haskins soils.

Wetness as a result of a seasonal high water table and the clayey subsoil is a severe limitation of Blount soils for farming. A moderate to severe erosion hazard on the Glynwood soils is a limitation for farming. Many of the nearly level, low lying areas of the association are subject to ponding in wet periods unless they are adequately drained. Moderately slow to slow permeability, in addition to wetness, is a severe limitation of the major soils for many nonfarm uses. Where slope is not limiting, Glynwood soils have fewer limitations for building sites than Blount soils.

Farming is the major land use on this association. Corn, soybeans, and small grain are the principal crops.

10. *Blount-Pewamo association*

Nearly level to gently sloping, somewhat poorly drained and very poorly drained soils that have a clayey and loamy subsoil; on uplands

This association occupies a strip several miles wide that extends from the northeast to the southwest in the western half of the county. Most areas are nearly level to gently sloping. Some of the more sloping areas occupy the sides of stream valleys and major drainageways.

This association makes up about 24 percent of the county. It is about 43 percent Blount soils, 19 percent Pewamo soils, and 38 percent soils of minor extent.

Blount and Pewamo soils formed in deposits of limy clay loam glacial till. Blount soils are somewhat poorly drained and are nearly level to gently sloping. Pewamo soils are nearly level and very poorly drained. They are on broad flats and in drainageways.

The moderately well drained Glynwood soils are minor in this association. They occupy the more sloping sides of stream valleys. Other minor soils are the very poorly drained Mermill, Bono, and Carlisle soils and the somewhat poorly drained Haskins soils.

Wetness caused by a seasonal high water table and a clayey subsoil are severe limitations for Blount and Pewamo soils for farming. Many of the nearly level, low lying areas of these soils are subject to ponding

during wet periods unless adequate drainage is provided. Moderately slow to slow permeability, in addition to wetness, is a severe limitation of the major soils for many nonfarm uses.

Most of the association is farmed. Corn, soybeans, and small grain are the major crops.

11. *Blount, loamy substratum-Glynwood association*

Nearly level to moderately steep, somewhat poorly drained and moderately well drained soils that have a clayey and loamy subsoil; on uplands

This association is in a diagonal strip that extends from the northeast to the southwest in the northwestern part of the county. Most areas are gently sloping to moderately steep with many short slopes. A few areas are steep.

This association makes up about 5 percent of the county. It is about 30 percent Blount soils, loamy substratum, 25 percent Glynwood soils, and 45 percent soils of minor extent.

The major soils formed in clay loam material underlain with limy loam or clay loam glacial till. Blount soils, loamy substratum, are somewhat poorly drained and nearly level to gently sloping. The Glynwood soils are moderately well drained and are mainly gently sloping to moderately steep.

Minor soils in drainageways and on level to depressional areas in the association are the very poorly drained Bono, Pewamo, and Mermill soils. The very poorly drained Carlisle and Wallkill soils are in local depressions or potholes. The somewhat poorly drained Haskins soils and the moderately well drained Rawson soils are on small knolls.

Wetness caused by a seasonal high water table and the clayey subsoil is a severe limitation of Blount, loamy substratum soils, for farming. The hazard of erosion is a limitation of the gently sloping to moderately steep Glynwood soils. Moderately slow to slow permeability is a severe limitation of the major soils for some nonfarm uses.

Most of the less sloping parts of this association are farmed. Corn, soybeans, and small grain are the major crops. Many of the sloping and moderately steep areas are used for permanent pasture or woodland.

12. *Glynwood-Rawson association*

Gently sloping to moderately steep, moderately well drained soils that have a loamy and clayey subsoil; on uplands

This association is a single area located in the northwest corner of the county. Most areas are gently sloping to moderately steep, but a few areas are steep.

This association makes up about 4 percent of the county. It is about 44 percent Glynwood soils, 15 percent Rawson soils, and 41 percent soils of minor extent.

Glynwood and Rawson soils are moderately well drained. The gently sloping to moderately steep Glynwood soils formed in clay loam material underlain with limy clay loam glacial till. The gently sloping to sloping Rawson soils formed in loamy material underlain by limy clay to clay loam glacial till.

Minor soils include the well drained Boyer, Oshtemo, and Spinks soils on long narrow sandy and gravelly ridges. The very poorly drained Carlisle and Wallkill soils are in local depressions or potholes. The very poorly drained Pewamo and Millgrove soils are along drainageways. The more gravelly areas near Rawson soils commonly consist of Haney soils.

A severe erosion hazard on the sloping to moderately steep soils is a major limitation for farming. The slow permeability of Glynwood soils is a severe limitation for some nonfarm uses.

Corn, soybeans, and small grain are grown on this association, but more than half the acreage is in permanent pasture and woodland. Where slope is no limitation and natural drainage is generally good, the major soils in the association provide some of the best building sites in the county. The less extensive Spinks soils are an excellent source of sand for filling and grading purposes.

Planning the Use and Management of the Soils

The soil survey is a detailed analysis and evaluation of the most basic resource of the survey area—the soil. It may be used to fit the use of the land, including urbanization, to the limitations and potentials of the natural resources and the environment and to help avoid soil-related failures in uses of the land.

During a soil survey soil scientists, conservationists, engineers, and others keep extensive notes, not only about the nature of the soils but also about unique aspects of behavior of these soils in the field and at construction sites. These notes include observations of erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic systems, and other factors relating the kinds of soil and their productivity, potentials, and limitations under various uses and management. In this way field experience incorporated with measured data on soil properties and performance is used as a basis for predicting soil behavior.

Information in this section will be useful in applying basic facts about the soils to plans and decisions for use and management of soils for crops and pasture, woodland, and many nonfarm uses, including building sites, highways and other transportation systems, sanitary facilities, parks and other recreational developments, and wildlife habitat. From the data presented, the potential of each soil for specified land uses may be determined, soil limitations to these land uses may be identified, and costly failures in homes and other structures, caused by unfavorable soil properties, can be avoided. A site can be selected where the soil properties are favorable, or practices can be planned that will overcome the soil limitations.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and environment are closely related to the nature of the soil. Plans can be made to maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information useful in locating sources of sand and gravel, road fill, and topsoil. Other information indicates the presence of bedrock, wet-

ness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and Pasture [1]

The major management concerns when using the soils for crops and pasture are described in this section. The system of land capability classification used by the Soil Conservation Service is explained, management of the soils by capability units is discussed, and the predicted yields of the main crops are presented for each soil.

This section provides information about the overall agricultural potential and needed practices in the survey area for those in agribusiness—equipment dealers, drainage contractors, fertilizer companies, processing companies, planners, conservationists, and others.

The principal crops grown in the county are corn, soybeans, winter wheat, spring oats, and mixed hay. Also grown are smaller acreages of tomatoes, sugar beets, and some truck crops. Only about 1 percent of the acreage in farms is in pasture.

The different kinds of soils in Williams County vary in their suitability for specific crops, and they require widely different management, but some general, or basic, management is needed on practically all of the soils. These basic practices are maintaining an adequate level of fertility, utilizing crop residue, improving drainage, controlling erosion, and using proper tillage. Management of groups of similar soils is discussed under the heading "Management by Capability Units."

Soil fertility.—About one-fourth of the soils in the county have dark colored surface layers. These soils are nearly neutral in reaction and contain moderate amounts of phosphorus and high amounts of potassium. Many of the light colored soils in the county are naturally acid and below optimum plant nutrient levels. 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 kinds and amounts of fertilizer and lime to apply. The current "Ohio Agronomy Guide" (*6*)[2] also gives fertilizer recommendations. The texture of the surface layer is important in the applications of fertilizer and herbicides. Generally, larger amounts of potassium are needed for sandy soils than for loams or silt loams. Loams and silt loams generally require larger amounts than do clayey soils.

Crop residue.—The organic-matter content of Williams County soils varies from about 1 percent to about 35 percent. Dark colored sandy or loamy mineral soils and muck soils are moderate to high in organic-matter content. Light colored soils and heavy textured dark colored soils generally are below the optimum levels of organic-matter content. All crop residues should be returned to the soil to maintain or increase the content of organic matter. Also regular additions of manure and other organic material can help to improve soil structure and to reduce surface crust formation. Both soil tilth and the amount of nitrogen in the soil are affected by the content of organic matter. Soybeans and similar crops supply only a small amount of residue, and if these are grown, the cropping system should include cover or sod crops.

Drainage.—Soil drainage is the major management need on about two-thirds of the soils in the county. Crops grow well on somewhat poorly drained and very poorly drained soils if excess water is removed by subsurface drains, surface drains, or land smoothing, or by a combination of these practices. Where these practices are not used, surface ponding and excess soil wetness slow the growth of crops. Also soils that are not adequately drained dry out and warm up slowly, and this delays tillage and planting.

The efficiency of artificial drainage in removing water varies on the different kinds of soils. Surface drainage is generally more efficient on the clayey soils. The lower rates of permeability allow removal of a greater volume of surface water before it enters the soil. Ponding occurs on low lying areas, even on the sandy soils, and this water can be effectively removed by surface drains.

Tile drains remove excess water from within the soil. The efficiency of this artificial drainage depends on soil permeability. Excess water is most readily removed from the sandy soils, such as Gilford, Lamson, and Rimer. Water removal is more difficult in the Colwood, Millgrove, Mermill, Kibbie, Digby, Haskins, and similar soils, but it is effective. Internal drainage is least effective in clayey soils. Removal is fair in the Lenawee, Hoytville, Del Ray, Pewamo, and Nappanee soils; poor in the Toledo, Fulton, and Latty soils; and very poor in the Paulding and Roselms soils. Although there is much artificial drainage in Williams County, many fields and farms remain inadequately drained.

Organic soils oxidize and subside when the pore space is filled with air; therefore, special drainage systems are needed to control the depth and the period of drainage. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of organic soils.

The moderately well drained and well drained soils do not normally need artificial drainage, but the surface drains from adjacent soils run through many areas. In some places random subsurface drains are needed in spots of wetter soils and in seep spots.

Although excess water is the major limitation on most of the soils in the county, some well drained and moderately well drained soils are too dry during part of the growing season unless rainfall is timely. The Spinks, Ottokee, Seward, Oshtemo, Haney, St. Clair, and Lucas soils frequently lack sufficient moisture for growing summer crops. Careful management is needed on these soils to help conserve soil moisture for crops.

Erosion.—Soil erosion is a major management problem on soils in the county that are gently sloping to

[1] CHARLES F. CUNNINGHAM, district conservationist, Soil Conservation Service, helped prepare this section.

[2] Italic numbers in parentheses refer to Literature Cited, p. 135.

very steep. These soils make up about one-third of the county. Loss of part of the surface layer reduces soil productivity and available water capacity and commonly results in heavier textured subsoil material being mixed with the surface layer in plowing. The heavier plow layer that results often causes serious tilth problems. Erosion control practices commonly used in the county are tilling on the contour; keeping tillage to a minimum; constructing terraces, waterways, and diversions; utilizing crop residue; and planting close-growing crops.

Soil blowing is a hazard on the sandy Arkport soils and on the organic Carlisle and Edwards soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing on these soils. Windbreaks of adapted shrubs, such as Tartarian honeysuckle or autumn olive, are effective in reducing soil blowing on the muck soils.

Tillage.—The tillage used in the county is primarily plowing and working the soils with a conventional plow, disk, or cultipacker. Many of the soils in the county could be tilled by minimum tillage or no-tillage methods. The Oshtemo, Millgrove, Mermill, Seward, Rimer, and other sandy and loamy soils are too wet to be plowed in spring.

For specific information regarding tillage practices and erosion control, consult a representative of the Williams Soil and Water Conservation District or the Ohio Cooperative Extension Service.

Special crops.—Sugar beets and tomatoes are the dominant special crops grown in the county. They are well suited to drained areas of Lenawee, Latty, Hoytville, Pewamo, Toledo, and other soils that are naturally very poorly drained. These soils have high organic-matter content and high available water capacity. The major limitation of these soils is soil compaction and the resultant decline in tilth. Good tilth and physical condition are essential if these soils are to produce good yields of sugar beets or tomatoes.

A small acreage of truck crops is also grown in the county. Truck crops are suited to loamy soils that warm up early in spring, for example, the well drained Belmore and moderately drained Haney soils. These soils have limited available water capacity, but they are well suited to irrigation.

A high level of soil management is needed for successful special crop production. Additional information regarding management practices for special crops can be obtained from the Ohio Cooperative Extension Service or from field representatives of the various commercial canneries or sugar companies operating in states of the Northwest.

Pasture.—Only about 1 percent of the acreage in farms is used for permanent pasture. This is because only a small percentage of the acreage cannot be cropped and because most of the forage needed is provided by meadow crops. Many soils in the county could be used for producing high-quality permanent pasture.

Most areas in pasture are on eroded soils that formerly were cultivated, on sloping to steep soils, or on soils that are frequently flooded. Some pastures near farmsteads are used for feedlots or access lanes. Some open woodlots are pastured, but they generally have sparse forage plants.

Yields of pasture vary widely; they depend on the kind of soil and the lay of the land. The sloping to steep soils in pasture are in the St. Clair and Lucas series. These soils are commonly eroded, and the water available to plants is low because runoff is rapid. Pasture plants generally grow slowly on these soils. Pasture plants also grow slowly on the sandy Boyer, Spinks, Oshtemo, and Ottokee soils because the available water capacity is low. Forage plants grow satisfactorily on the less sloping St. Clair and Lucas soils and the gently sloping Nappanee and Fulton soils, but these soils are subject to erosion if the plant cover is removed by tillage or is reduced by overgrazing. Severe soil compaction occurs if livestock trample these soils during wet periods.

The Sloan and Shoals soils on flood plains potentially are well suited to permanent pasture. Areas of these soils commonly are small in size and irregular in shape. Flooding during the growing season damages cash crops, but the soils are fertile, have high available water capacity, and can produce good grass or grass-legume pasture. Surface and subsurface drains help to control excess water, especially where legumes are grown.

Permanent pasture needs about the same management as does cropland. Lime and fertilizer should be applied at rates indicated by soil tests. Control of weeds by periodic clipping and use of recommended herbicides encourages the growth of desirable plants. Proper stocking rates and controlled grazing also encourage the growth of desirable plants. Latest recommendations on seeding mixtures, herbicide treatment, and other management on specific soils can be obtained from the Ohio Cooperative Extension Agent or from the office of the Williams Soil and Water Conservation District.

Irrigation.—Williams County generally receives enough rainfall to supply moisture for crops, but intervals commonly occur when rainfall is insufficient. Supplemental irrigation of cropland or pasture during these dry periods helps to increase the growth of crops and forage plants.

To be suitable for irrigation, the surface layer should be porous or able to absorb water readily. The surface layer and subsoil should also have a high available water capacity. The soils should be nearly level or no more than gently sloping so that erosion is not a serious problem. Soils should be permeable so that water and air will move freely and prevent waterlogging, which adversely affects plants. Good drainage is essential.

The soils in Williams County vary in their suitability for irrigation. The sandy soils, such as the Ottokee, Tedrow, Seward, Rimer, Boyer, Oshtemo, and Gilford soils, are very permeable but lack adequate available water capacity. Irrigation of these soils has to be more frequent than on loamy soils. The soils that are most suitable for irrigation, from the standpoint of permeability and available water capacity, are the Haney, Digby, Kibbie, Colwood, Millgrove, Mermill, Rawson, and Genesee soils. Digby, Kibbie, Colwood, Millgrove, and Mermill soils should be artificially drained before they are irrigated. The finer textured silty clay loam,

clay, and silty clay soils, such as the Latty, Toledo, Nappanee, and Paulding soils, are poorly suited to irrigation because they are slowly permeable.

Before irrigation, an adequate supply of water is necessary. Use of water in streams and ponds may be restricted, because water rights of the downstream users must be considered.

Additional information about the soils and their management for irrigation is available from the Williams County Soil and Water Conservation District and the Ohio Cooperative Extension Agent.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account the major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. This classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees, or for engineering purposes.

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

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

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.
- 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 landforms 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 too cold or too dry.

TABLE 1.—*Capability classes and subclasses*

[Miscellaneous areas excluded. Absence of an entry means no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	*Acres*	*Acres*
I				
II	196,310	74,300	122,010	
III	64,122	18,882	39,508	5,732
IV	3,908	3,684	224	
V				
VI	947	947		
VII	949	949		
VIII				

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, though they have other limitations that restrict their use to pasture, woodland, wildlife, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 1. All land in the county except borrow pits, gravel pits, Urban land, and other miscellaneous areas is included. Some of the soils that are well suited to crops and pasture, for example, soils in capability classes I and II, are now used for woodland or other low intensity uses. Data in this table can be used to determine the farming potential of the area.

The capability unit is identified in the description of each soil map unit in the section "Descriptions of the Soils." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-2.

Management by capability units

In the following pages are descriptions of the capability units used in Williams County. Udorthents, Urban land, Gravel pits, Made land, and Sand pits were not assigned to a capability unit.

The descriptions of the capability units give the properties and qualities of the soils within the unit. Because the soils in any one capability unit have about the same limitations and similar risks of damage, they need about the same kind of management. In some

units, there are one or two soils that have properties or qualities different from those of the rest of the soils in the group. These exceptions are included in a capability unit because they have a small acreage that does not justify a separate description, or they are similar in many respects to the other soils in the unit. By including exceptions, the number of capability units is kept to a practical minimum. The exceptions are noted if there is a significant difference for either use or management.

Low, medium, or high available water capacity refers to the normal root depth of commonly grown field crops. The depth of the rooting zone refers to the depth of soil to a root restricting layer, such as dense clay, compact till, highly calcareous material, or bedrock.

These descriptions note the dominant limitations of the soils for farm use, but they do not give specific recommendations for overcoming them. Erosion control or drainage, for example, can be achieved by many methods or combinations of practices on any given field of any kind of soil. For specific information regarding erosion varieties, or other management practices, the reader should contact the local soil and water conservation district or the Ohio Cooperative Extension Agent.

CAPABILITY UNIT IIe-1

The soils in this unit are nearly level to gently sloping and are moderately well drained to well drained. They are on stream terraces, beach ridges, and uplands. They have a moderately deep to deep root zone, a moderate to high available water capacity, and a moderate to high productivity potential. Permeability is moderate or moderately rapid in the upper layers but very slow to rapid in the lower layers. The underlying material ranges from clay to sand and gravel.

A moderate erosion hazard is the major limitation for farming. Maintaining fertility, soil structure, and organic-matter content are also management concerns. Contour farming and minimum tillage are commonly used as erosion control measures.

These soils are suited to all row, small grain, hay, and pasture crops commonly grown in the county. They are well suited to most specialty and fruit crops. Irrigation is effective in dry years.

CAPABILITY UNIT IIe-2

The soils in this unit are gently sloping and moderately well drained. They are on moraines, till plains, and lake plains, mainly along slope breaks to the major streams and tributaries in the county. They have a moderately deep to deep root zone, moderate available water capacity, and a moderate productivity potential. Permeability is moderately slow to slow. Eroded spots are sticky when wet and droughty in dry seasons.

A moderate erosion hazard is the major limitation for farming. Maintaining fertility, soil structure, and organic-matter content are concerns if the soils are cultivated. Drainage is not generally needed except in occasional small wet spots. Contour farming and minimum tillage are commonly used as erosion control measures.

These soils are suited to row, small grain, hay, and pasture crops commonly grown in the county.

CAPABILITY UNIT IIe-3

The soils in this unit are gently sloping and are moderately well drained or well drained. These sandy soils are on low knolls throughout the county and along the edge of the lake plain. They have a moderately deep to deep root zone, low available water capacity, and moderate productivity potential. Permeability is moderately rapid to rapid, but some soils have clayey layers in the lower subsoil that are very slowly permeable.

A moderate erosion hazard and a moderate drought hazard are the major limitations of these soils. Maintaining fertility and organic-matter content are management concerns. Minimum tillage and contour farming aid in controlling erosion. In the spring, soil blowing is a hazard in cultivated fields and in areas without a plant cover. A few wet spots may need to be drained, but deep ditching may be necessary to reach an outlet. Excavations for subsurface drains may cave in. Sand tends to sift into installed tile and eventually plugs it.

These soils are suited to row, small grain, hay, and pasture crops commonly grown in the county. They are not well suited to specialty crops unless carefully managed. The soils are suited to orchards if irrigated.

CAPABILITY UNIT IIe-4

The soils in this unit are gently sloping and somewhat poorly drained. They are on the Wabash and Fort Wayne Moraines and along slope breaks to the major streams of the county. They have a seasonal high water table and stay wet until late in spring unless they are drained. These soils have a moderately deep to deep root zone, moderate to high available water capacity, and a moderate productivity potential. Permeability is slow to moderately slow.

An erosion hazard is the major limitation for farming. Maintaining a good vegetative cover and use of minimum tillage will help reduce the hazard of erosion. The seasonal high water table is also a limitation. Subsurface drains are effective where adequate outlets are available. Maintaining good soil structure is a management concern.

These soils are suited to all field crops commonly grown in the county. They are suited to pasture and to some specialty crops.

CAPABILITY UNIT IIw-1

The soils in this unit are nearly level and are moderately well drained to well drained. They are on flood plains adjacent to the major streams in the county. These soils are subject to occasional flooding. They have a deep root zone, a moderate to high available water capacity, and high productivity potential. Permeability is moderate to moderately rapid.

The hazard of flooding is the principal limitation of these soils. Eel soils lie a little lower and are flooded more often and for a longer duration than the other soils in this unit. Scouring from past flooding often leaves surfaces somewhat uneven. Flood debris may hamper field operations. Subsurface drainage is not normally needed on these soils, but surface drains can be used to remove standing water from low areas.

These soils are well suited to row crops, such as corn and soybeans. Winter and early spring floods

frequently damage small grain crops. These soils are well suited to specialty crops, but flood control measures are necessary. They are well suited to irrigation.

CAPABILITY UNIT IIw-2

The soils in this unit are nearly level and somewhat poorly drained. They are on flood plains bordering the major streams in the county. These soils are subject to flooding. They have a deep root zone, moderate to high available water capacity, and high productivity potential. Permeability is moderate to moderately rapid.

A seasonal high water table and the hazard of flooding are the major limitations for farming. The seasonal high water table can be lowered by subsurface drains if suitable outlets are available. Surface wetness and ponding can be reduced by shallow ditches and by diversions at the base of adjacent slopes.

Drained areas are well suited to row crops, such as corn and soybeans, but are of limited use for small grain and most hay crops. Water-tolerant hay and pasture plants should be grown. Frequently flooded areas should be protected by trees or by grass.

CAPABILITY UNIT IIw-3

The soils in this unit are nearly level to gently sloping and somewhat poorly drained. They are on the lake plain, terraces, and uplands throughout the county. They have a seasonal high water table and stay wet until late in spring unless they are drained. These soils have a moderately deep to deep root zone, moderate to high available water capacity, and moderate productivity potential. Permeability is mostly moderate. Some soils have clayey layers in the lower part of the subsoil that are slowly or very slowly permeable, and others have sandy substrata that are rapidly permeable.

Wetness is the major limitation. Erosion is a hazard on long, gentle slopes. The seasonal high water table can be lowered by subsurface drains where adequate outlets are available.

These soils are well suited to all row, small grain, hay, and pasture crops commonly grown in the county. These soils can be continuously cultivated if well managed. They are suited to specialty crops. They are also suited to irrigation. Farming on the contour helps reduce erosion caused by runoff.

CAPABILITY UNIT IIw-4

Rimer loamy fine sand, 0 to 3 percent slopes, is the only soil in this unit. It is nearly level to gently sloping, sandy textured, and somewhat poorly drained. It occurs in scattered areas on the lake plain and in parts of beach ridge systems. It has a moderately deep root zone, low to moderate available water capacity, and moderate to low productivity potential. Permeability is rapid to moderately rapid in the upper part. The clayey layers in the lower part of the subsoil and substratum are very slowly permeable.

A seasonal high water table is the major limitation for farming. The soil responds well to subsurface drainage where outlets are available. Pump drainage is needed where ditch outlets are unsatisfactory. Soil blowing is also a hazard if the soil is not protected by a vegetative cover.

This soil is well suited to all field crops commonly grown in the county. It can be row cropped frequently if well managed. The soil should be kept under vegetation or stubble as much as possible to reduce the hazard of soil blowing. It is suited to irrigation.

CAPABILITY UNIT IIw-5

The soils in this unit are nearly level and somewhat poorly drained. They are on the Wabash and Fort Wayne moraines and along slope breaks to the major streams of the county. They have a seasonal high water table and stay wet until late in spring unless drained. These soils have a moderately deep to deep root zone, moderate to high available water capacity, and a moderate productivity potential. Permeability is slow to moderately slow.

Wetness is the major limitation, The seasonal high water table can be lowered by subsurface drains where adequate outlets are available. Maintaining good soil structure is a management concern.

These soils are suited to all field crops commonly grown in the county. They are also suited to pasture and to some specialty crops.

CAPABILITY UNIT IIw-6

The soils in this unit are nearly level and very poorly drained. They occur throughout the county on the lake plain, terraces, and uplands. They have a moderately deep to deep root zone, high to moderate available water capacity, and very high productivity potential. Permeability is mostly moderate to moderately slow. A few soils have sandy and gravelly material below a depth of 28 inches that has moderately rapid permeability. Other soils have clayey materials in the lower part of the subsoil and substratum that are very slowly permeable.

Wetness is the major limitation of these soils. Maintaining good structure is a management concern in most of the soils. The seasonal high water table can be lowered by subsurface drains where adequate outlets are available.

These soils are well suited to all row crops, small grain, hay, and pasture crops commonly grown in the county. They are also well suited to specialty crops. The soils can be used intensively for row crops if well managed.

CAPABILITY UNIT IIw-7

The soils in this unit are nearly level and very poorly drained. They occur throughout the county on the lake plain and uplands. They have a deep root zone, high available water capacity, and high productivity potential. Permeability is moderately slow to slow.

Wetness is the major limitation of these soils. Maintaining good structure is a concern if the soils are worked when wet. The seasonal high water table can be lowered by subsurface drains. Surface ponding can be controlled by surface drains where adequate outlets are available.

These soils are well suited to all crops commonly grown in the county if adequately drained and are suited to some specialty crops. The soils can be continuously row cropped if well managed. They are suited to irrigation.

CAPABILITY UNIT IIw-8

The soils in this unit are nearly level and very poorly drained. They are in depressions on the uplands and along some drainageways. Organic layers begin at a depth of 16 to 40 inches. Permeability is moderate to slow in the upper layers and moderately rapid to rapid in the organic layers. The soils have a deep root zone, a high available water capacity, and a high productivity potential.

Severe wetness is the major limitation. Maintaining good structure and tilth of the surface layer is a management concern, especially if the soils are worked when wet. Subsurface drainage, surface drainage, and diversions to control runoff from adjacent slopes reduce wetness in these soils. Pump drainage is sometimes used when outlets for subsurface drainage are not available.

Drained areas of these soils are well suited to row crops, such as corn. The hazards of flooding or ponding are limitations to small grain and certain hay crops. Where the soils are used for hay or pasture, water-tolerant plants should be grown.

CAPABILITY UNIT IIw-9

The soils in this unit are nearly level and very poorly drained. They are on lake plains and terraces adjacent to major streams. These soils formed in stratified medium to coarse textured materials. They have a deep root zone, a moderate available water capacity, and a high productivity potential. Permeability is moderate to moderately rapid.

Wetness is the major limitation. The seasonal high water table can be lowered by subsurface drains where adequate outlets are available. The cut banks of tile trenches, however, are likely to cave. Also, sand can wash into and plug the tile.

These soils are well suited to all row, small grain, hay, and pasture crops commonly grown in the county and to some specialty crops. They can be planted frequently to row crops if well managed. They are suited to irrigation.

CAPABILITY UNIT IIIe-1

The soils in this unit are sloping and are moderately well drained. They occur on terraces adjacent to major streams, on the uplands, and on the lake plain. They have a moderately deep to deep root zone, moderate to high available water capacity, and moderate to high productivity potential. Permeability is moderate to moderately rapid in the upper layers but ranges from very slow to rapid in the lower layers. These soils are underlain by materials ranging from clay to sand and gravel.

A severe erosion hazard is the major limitation of these soils if they are cropped. Maintaining fertility, good soil structure, and organic-matter content are management concerns if they are frequently cultivated.

These soils are suited to grain, hay, and pasture crops commonly grown in the county. They are not well suited to specialty crops unless carefully managed. Erosion losses can be minimized if crops are grown that provide vegetative cover during most of the growing season. Management practices, such as contour farming, terraces and diversions, help to control erosion. Areas in pasture will erode if stand density is reduced by overgrazing.

CAPABILITY UNIT IIIe-2

The soils in this unit are gently sloping to sloping and are moderately well drained. They occur on the Wabash and Fort Wayne Moraines and along slope breaks to the major streams of the county. They have a moderately deep to deep root zone, moderate available water capacity, and moderate productivity potential. Permeability is moderately slow to very slow. Some soils are moderately eroded.

A severe erosion hazard is the major limitation of these soils. Maintaining soil structure and organic-matter content are concerns if the soils are cultivated.

These soils are suited to the grain, hay, and pasture crops commonly grown in the county. They are not well suited to specialty crops. Practices to control erosion, such as terraces, should be used if row crops are grown. Crops that provide a vegetative cover during most of the growing season will minimize the erosion hazard. Controlled grazing to provide adequate pasture cover will also help control erosion.

CAPABILITY UNIT IIIe-3

Blount loam, 2 to 6 percent slopes, moderately eroded, is the only soil in this unit. It is somewhat poorly drained. This soil is on the upland till plains and moraines along drainageways and on low rises. It has a moderately deep root zone, moderate available water capacity, and moderate productivity potential. Permeability is slow to moderately slow.

A severe erosion hazard is the major limitation of this soil. Maintaining good structure and organic-matter content are management concerns if the soil is cultivated. Wetness is also a limitation, and subsurface drainage is needed to lower the seasonal high water table.

This soil is suited to grain, hay, and pasture crops commonly grown in the county. It is not well suited to specialty crops. The hazard of erosion is minimized if row crops are grown with appropriate erosion control practices. Crops that provide a vegetative cover during most of the growing season also minimize the erosion hazard. Pastures should be managed to provide adequate cover for erosion control.

CAPABILITY UNIT IIIe-4

The soils in this unit are sloping to moderately steep and are well drained. They are on beach ridges and terraces adjacent to major streams in the county. They have a moderately deep to deep root zone, low available water capacity, and low to moderate productivity potential. Permeability is moderately rapid to rapid. These soils formed in deposits of sand or sand and gravel.

Severe erosion and drought hazards are the major limitations. Soil blowing is a problem on the more sandy soils. The organic-matter content is low but can be increased by incorporating crop residues and green manure crops into the surface layer.

These soils are suited to all grain, hay, and pasture crops commonly grown in the county. Yields are low in dry years. Erosion control practices, such as terraces and crop rotations or minimum tillage, should be used

to control runoff. Overgrazing of pastures should be avoided because of the erosion hazard.

CAPABILITY UNIT IIIw-1

The soils in this unit are nearly level and very poorly drained. They are on flood plains adjacent to the major streams in the county. They have a deep root zone, moderate to high available water capacity, and high productivity potential. Permeability is moderately slow to moderately rapid.

Wetness from a seasonal high water table is the major limitation. The hazard of frequent flooding is also a limitation. Subsurface and surface drains remove excess water where adequate outlets are available. Runoff from adjacent slopes can be intercepted by diversions along the base of the slope. Maintaining soil structure in the silty clay loam soils is a management concern, because the soils are frequently tilled or pastured when wet.

If these soils are drained, they are suited to row crops, such as corn and soybeans. Winter grains are not generally grown because of winter and spring flooding damage. Areas that are flooded frequently throughout the year should be used for pasture or woodland.

CAPABILITY UNIT IIIw-2

The soils in this unit are nearly level and are very poorly drained. They occur on the lake plain and in depressions on till plains and moraines. They have a deep root zone, moderate available water capacity, and moderate to high productivity potential. Permeability is slow to very slow.

Excess wetness is the major limitation of these soils. They have a seasonal high water table and are subject to surface ponding during winter and spring. Maintaining good soil structure is difficult if the soils are frequently tilled or grazed when wet. A combination of surface and subsurface drainage is commonly needed to remove the excess water from the soils.

These soils are suited to row, small grain, hay, and pasture crops. Ponding is a hazard to winter wheat in improperly drained areas. Some of these soils are suited to certain specialty crops.

CAPABILITY UNIT IIIw-3

The soils in this unit are nearly level to gently sloping and are somewhat poorly drained. They are on slight rises on lake plains. They have a moderately deep root zone, moderate available water capacity, and moderate productivity potential. Permeability is slow to very slow.

Excess wetness is the major limitation of these soils. Soil erosion is also a limitation in gently sloping areas. Maintaining good soil structure is a problem, especially if the soils are tilled when wet. Soils with a silty clay loam surface layer are subject to crusting after heavy rains. The seasonal high water table can be lowered by subsurface drains, but they are only moderately effective in the more clayey soils.

These soils are suited to row, small grain, hay, and pasture crops commonly grown in the county. The nearly level soils are suited to a slightly more intensive cropping system than the gently sloping soils. Cropping systems should include some grasses and legumes. These crops help maintain good soil structure.

CAPABILITY UNIT IIIw-4

Carlisle muck is the only soil in this unit. It is nearly level and is very poorly drained. This organic soil occurs in small to large depressions on uplands. It has a deep root zone, high available water capacity, and a high productivity potential. Permeability is moderately slow to moderately rapid.

Wetness is a very severe hazard, and soil blowing is a severe hazard. Wetness is a result of a high water table and runoff from adjacent slopes. In some areas the runoff can be intercepted by diversions. Where outlets are available, subsurface drainage systems are commonly used to lower the water table. Soil blowing is a hazard when the surface is dry and exposed.

Drained areas are well suited to row crops and some specialty crops but are of limited use for small grain and certain hay crops. Ponding in winter and spring limits small grain and certain hay crops. Where the soil is used for hay or pasture, water-tolerant plants should be selected. Excessive tillage accelerates oxidation of the organic matter in the soil and should be avoided.

This soil is suited to irrigation.

CAPABILITY UNIT IIIe-1

The soils in this unit are nearly level to gently sloping and moderately well drained or well drained. They occupy beach ridges, sandy knolls on the lake plain, and terraces along the major streams in the county. These soils formed in sand or sand and gravel. They have a moderately deep to deep root zone, a low available water capacity, and a moderate productivity potential. Permeability is moderately rapid to rapid.

A severe drought hazard is the major limitation. Soil blowing is a hazard in cultivated and open fields. The organic-matter content is low but can be increased by incorporating crop residues and green manure crops into the soil.

These soils are suited to row, small grain, hay, and pasture crops commonly grown in the county. Cropping systems should include small grain, grasses, and legumes. Early maturing crops are the more successful on these soils because of droughtiness in summer.

CAPABILITY UNIT IVe-1

The soils in this unit are sloping to moderately steep and are moderately well drained. They occupy positions on the Wabash and Fort Wayne Moraines and along slope breaks to the larger streams throughout the county. They have a moderately deep root zone, moderate available water capacity, and moderate productivity potential. Permeability is slow to very slow. These soils are moderately eroded.

A severe erosion hazard is the major limitation for farming. Maintaining fertility, good soil structure, and organic-matter content are management concerns. Serious compaction and destruction of soil structure occurs in areas where these soils have been worked or pastured while too wet.

These soils are suited to all row, small grain, hay, and pasture crops commonly grown in the county,

but yields are reduced by erosion damage and soil structure problems. Tillage and seedbed preparation should be minimal. Minimum tillage lessens soil structure damage and surface crusting problems. Crop rotations should include crops that provide good vegetative cover in most years. Hay and pasture should be managed so that an adequate vegetative cover protects the soils from erosion.

CAPABILITY UNIT IVe-2

Boyer gravelly loamy sand, 12 to 18 percent slopes, is the only soil in this unit. It is moderately steep and well drained. This soil is mainly on outwash plains and stream terraces. It has a moderately deep root zone, a low available water capacity, and a low to moderate productivity potential. Permeability is moderately rapid.

A severe erosion hazard is the major limitation for farming. Droughtiness is also a limitation and reduces crop yields in dry years.

Organic-matter content is low. It can be increased and droughtiness can be reduced by incorporating green manure crops and crop residues into the surface layer.

This soil is suited to row, hay, and pasture crops commonly grown in the county. All crop yields are reduced in extended dry periods. Erosion can be controlled by minimum tillage, by leaving crop residue on the surface, and by a cropping system which provides close growing crop cover most of the time. Hay and pasture should be managed so that an adequate vegetative cover protects the soil from erosion.

CAPABILITY UNIT IVw-1

The soils in this unit are nearly level and are very poorly drained. These organic soils are in small to large depressions on uplands. They have a moderately deep to deep root zone, high available water capacity, and a moderate to high productivity potential. Permeability is moderately rapid. Marl is at a depth of about 1 to 4 feet.

Wetness is a very severe hazard and soil blowing is a severe hazard. Wetness is caused by a high water table and a concentration of runoff from adjacent slopes. Where outlets are available, subsurface drainage systems are commonly used to lower the water table. Soil blowing occurs when the surface of the muck is dry and exposed.

Drained areas are well suited to row crops, such as corn, but are of limited use for small grain and certain hay crops. Ponding in winter and in spring is the major limitation for small grain, especially winter wheat, and for certain hay crops. Where the soils are used for hay or pasture, water-tolerant plants should be selected. Excessive tillage accelerates oxidation of the organic matter. Soil blowing can be reduced by keeping the soils under a vegetative cover.

CAPABILITY UNIT VIe-1

The soils in this unit are moderately steep to steep and are moderately well drained. They are on the Wabash and Fort Wayne Moraines and along slope breaks to the major streams elsewhere in the county. They have a moderately deep root zone, moderate available water capacity, and moderate productivity potential. Permeability is slow to very slow. These soils are moderately eroded.

A severe erosion hazard is the major limitation of these soils. They are best suited to legume-grass meadows or pastures. Soil compaction occurs if the soils are pastured when wet.

These soils are suited to hay and pasture crops commonly grown in the county. They are generally not suited to row crops. Meadow is commonly reseeded with winter grain, but tillage should be minimal.

CAPABILITY UNIT VIIe-1

Glynwood loam, 18 to 40 percent slopes, moderately eroded, is the only soil in this unit. It is steep to very steep and is moderately well drained. It is on the Wabash and Fort Wayne Moraines and along slope breaks to the major streams and their tributaries throughout the county. It has a moderately deep root zone, moderate available water capacity, and low to moderate productivity potential. Permeability is slow.

A very severe erosion hazard is the main limitation of this soil. It is not suited to cultivated crops or hay. Operating equipment on these slopes is hazardous.

This soil is suited to pasture plants commonly grown in the area. Protection from overgrazing is needed to maintain an adequate vegetative cover to control erosion.

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 2. 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. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 2.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the

crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils 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 2 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Cow-acre-days are not given for pasture in the table. They can be calculated from the hay yields indicated in table 2 by converting tons of hay to pounds by multiplying tons by 2,000 and then dividing by 40. The result is the cow-acre-days per year of pasture. Example: 5-ton hay yield X 2,000 = 10,000 pounds. 10,000 divided by 40 = 250 cow-acre-days per year of pasture.

Woodland Management and Productivity [3]

The primitive forest of Williams County was tall and dense, except for a few hundred acres of oak openings in Northwest Township. It was timbered with the common varieties, most of which still grow in the remaining small woodlands of the county.

These varieties include American elm, American beech, bur oak, white ash, red maple, sugar maple, American basswood, American sycamore, black oak, northern red oak, white oak, black ash, ironwood, Ohio buckeye, black walnut, eastern white pine, yellow-poplar, and American chestnut. The understory is often dogwood, elder, black haw, plum, choke cherry, wild crab, prickly ash, paw paw, and sumac.

The earliest settlers hewed their homes out of this wilderness. They grew corn under girdled trees and rounded out their diets with game and wild berries.

Settlement increased during the canal boom of the 1830's and 1840's. Many settlers came to this area from Southeast Ohio and Pennsylvania, where the soil was becoming exhausted.

The forest stood between these pioneers and subsistence agriculture. Until a plot had been cleared and food crops planted, the threat of starvation was ever present.

It is understandable how a tremendous forest resource was wantonly destroyed under these conditions. Even such a scarce and valuable species as black walnut was cut for fencing.

Today only about 10 percent of the county remains in tree cover. These areas are mainly small scattered woodlots. The woodland pattern is heaviest in the uplands of the northwest corner of the county.

Table 3 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Mapping unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland 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 insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 3 the soils are also rated for a number of factors to be considered in management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations.

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 some 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 equipment; *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 that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate* that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *important 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

[3] A. NORRIS QUAM, woodland conservationist, Soil Conservation Service, helped prepare this section.

TABLE 2.—*Yields per acre of crops and pasture*

[All yields were estimated for a high level of management in 1975. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Soybeans	Wheat, winter	Oats	Grass-legume hay
	Bu	*Bu*	*Bu*	*Bu*	*Ton*
Arkport:					
ApB	90	32	40	75	3.5
Belmore:					
BlB	90	30	40	80	4.0
Blount:					
BnA, BoA	110	40	50	76	4.6
BnB, BnB2, BoB	105	36	48	74	4.6
Bono:					
Bp	120	40	----	80	4.5
Boyer:					
BrB	85	36	40	76	3.8
BrC	70	26	32	66	3.6
BsD	----	----	26	56	3.4
Carlisle:					
Ca	120	42	----	----	----
Ceresco:					
Ce	105	40	----	----	4.0
Cohoctah:					
Ch	120	45	----	----	4.8
Colwood:					
Cp	130	45	55	88	5.5
Del Rey:					
DeA, DfA	110	38	46	72	4.5
DeB, DfB	105	35	42	65	4.5
Digby:					
DgA	110	40	46	80	4.4
DmA	115	42	48	82	4.6
Edwards:					
Ed	110	38	----	----	----
Eel:					
Ee	120	42	----	----	5.0
Fulton:					
FsA, FuA	100	38	38	70	3.8
FsB, FuB	95	35	40	70	3.8
Genesee:					
Ge	120	42	----	----	5.0
Gilford:					
Gf	125	48	50	88	5.4
Glynwood:					
GlB	95	35	45	78	4.0
GlB2	90	30	38	72	3.8
GlC	90	33	40	75	3.8
GlC2	85	28	32	65	3.8
GlD2	----	----	30	65	3.6
GlE2	----	----	----	----	3.4
Haney:					
HaB	100	40	48	80	4.4
[1] HeB	100	38	46	82	4.4
[1] HeC	95	34	44	78	4.2
Haskins:					
HkA	105	40	46	76	4.0
HnA	110	42	46	78	4.4

TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Corn	Soybeans	Wheat, winter	Oats	Grass-legume hay
	Bu	*Bu*	*Bu*	*Bu*	*Ton*
Hoytville:					
Hv	120	42	50	78	5.0
Kibbie:					
KlA	115	40	50	78	4.6
KlB	110	38	45	75	4.2
Lamson:					
La	130	48	50	80	5.4
Landes:					
Lb	95	32	40	75	4.0
Latty:					
Lc	115	42	45	75	5.0
Lenawee:					
Lf	110	38	48	75	5.0
Lucas:					
LuB2	85	30	40	75	3.5
LuC2	80	20	30	70	3.0
LuD2	----	----	24	55	2.8
Martisco:					
Ma	100	34	----	----	----
Mermill:					
Md	125	44	50	85	5.4
Millgrove:					
Mh	125	40	50	85	5.4
Mk	115	35	45	85	5.4
Nappanee:					
NnA, NpA	95	36	40	70	3.8
NnB	85	32	40	72	3.8
Oshtemo:					
OrB	80	28	35	70	3.0
OrC	70	24	30	65	2.5
OsB	85	30	40	75	3.5
Ottokee:					
OtB	90	34	40	75	3.5
Paulding:					
Pa	105	40	42	70	4.0
Pewamo:					
Pm	120	45	48	75	5.0
Rawson:					
RlB	100	35	42	82	4.0
RlC, RmC	95	30	38	76	3.8
RmB	105	38	46	84	4.2
Rimer:					
RnA	95	36	40	75	4.0
Roselms:					
RsA, RsB	65	30	30	55	3.5
St. Clair:					
SbB2	95	35	40	70	3.5
SbC2	85	30	35	60	3.2
SbD2	----	----	30	50	3.0
Seward:					
SdB	90	30	34	75	3.5
Shinrock:					
SgB	110	40	50	80	4.5
SgC	105	32	45	74	4.2

TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Corn	Soybeans	Wheat, winter	Oats	Grass-legume hay
	Bu	*Bu*	*Bu*	*Bu*	*Ton*
Shoals:					
Sh	115	40			5.0
Sloan:					
Sn, So	120	42			5.0
Spinks:					
SpB	80	27	35	70	3.0
SpC	70	24	30	65	2.0
Toledo:					
To	120	42	45	75	5.0
Tuscola variant:					
TuB	110	40	50	80	4.5
TuC	100	35	45	75	4.0
Udorthents:					
Ud.					
Urban land:					
Ur.					
Wallkill:					
Wc	100	40			4.5
Wallkill variant:					
Wk	10	40			4.5

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

fully stocked, even-aged, unmanaged stands (*11*). Important 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 suitable for commercial wood production and that are suited to the soils.

Engineering[4]

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, contractors, and farmers.

The ratings in tables in this section are based on test data and estimated data in the "Soil Properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to and hardness of bedrock within 5 or 6 feet of the surface, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to—(1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand,

[4] WAYNE E. ACHOR, civil engineer, Soil Conservation Service, helped prepare this section.

TABLE 3.—*Woodland management and productivity*

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Important trees	Site index	
Arkport:								
ApB	3s	Slight	Slight	Slight	Slight	Sugar maple	70	Norway spruce, red pine, eastern white pine.
						White oak	75	
						Northern red oak	80	
Belmore:								
BlB	2o	Slight	Slight	Slight	Slight	Northern red oak	80	Eastern white pine, black walnut, yellow-poplar.
						White oak		
						Black walnut		
						Black cherry		
Blount:								
BnA, BnB, BnB2, BoA, BoB	3w	Slight	Moderate	Slight	Slight	White oak	65	Eastern white pine, yellow-poplar.
						Northern red oak	65	
						White ash		
						Bur oak		
						Pin oak		
Bono:								
Bp	3w	Slight	Severe	Severe	Severe	Pin oak	80	Red maple, White ash.
						Swamp white oak	80	
						White ash		
						Red maple		
Boyer:								
BrB, BrC, BsD	3s	Slight	Slight	Moderate	Slight	White oak	70	Eastern white pine, red pine.
						Red pine	78	
						Eastern white pine	85	
						Northern red oak	75	
						Sugar maple		
Carlisle:								
Ca	4w	Slight	Severe	Severe	Severe	Red maple	46	
						White ash		
						Black cherry		
						Swamp white oak		
						Silver maple		
Ceresco:								
Ce	2w	Slight	Moderate	Slight	Slight	Northern red oak	66	Eastern white pine, white spruce, eastern cottonwood.
						White ash		
						Red maple		
						Silver maple		
						Eastern cottonwood		
						American sycamore		
						Hackberry		
						Black walnut		
Cohoctah:								
Ch	2w	Slight	Severe	Severe	Moderate	Red maple	66	Eastern cottonwood, American sycamore, red maple.
						Eastern cottonwood		
						Silver maple		
						White ash		
						Swamp white oak		
						American sycamore		
Colwood:								
Cp	2w	Slight	Severe	Severe	Severe	Pin oak	90	Norway spruce, white ash, red maple.
						Swamp white oak		
						Red maple		
						White ash		

TABLE 3.—*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	Important trees	Site index	
Del Rey:								
DeA, DeB, DfA, DfB	3w	Slight	Moderate	Slight	Slight	White oak	70	White ash, eastern white pine, yellow-poplar.
						Northern red oak	70	
						White ash		
						Bur oak		
						Pin oak		
						Black cherry		
						Eastern cottonwood		
Digby:								
DgA, DmA	2w	Slight	Moderate	Slight	Slight	Northern red oak	80	White ash, eastern white pine, yellow-poplar.
						White oak	75	
						White ash		
						Pin oak		
Edwards:								
Ed	5w	Slight	Severe	Severe	Severe	Red maple	46	
						White ash		
						Black cherry		
						Swamp white oak		
						Silver maple		
Eel:								
Ee	1o	Slight	Slight	Slight	Slight	Yellow-poplar	100	Eastern white pine, black walnut, yellow-poplar.
						Eastern cottonwood		
						White ash		
						Black walnut		
Fulton:								
FsA, FsB, FuA, FuB	3w	Slight	Moderate	Moderate	Slight	Northern red oak	70	White ash, white spruce, eastern white pine.
						Pin oak	80	
						Swamp white oak		
Genesee:								
Ge	1o	Slight	Slight	Slight	Slight	Yellow-poplar	100	Eastern white pine, black walnut, yellow-poplar.
						Eastern cottonwood		
						White ash		
						Black walnut		
Gilford:								
Gf	4w	Slight	Severe	Severe	Severe	Pin oak	70	White spruce, white ash, red maple.
						Red maple		
						Swamp white oak		
						Silver maple	70	
Glynwood:								
GlB, GlB2, GlC, GlC2	2o	Slight	Slight	Slight	Slight	Northern red oak	80	Eastern white pine, yellow-poplar, black walnut.
						Black oak	80	
						White oak	75	
GlD2, GlE2	2r	Moderate	Moderate	Slight	Slight	Northern red oak	80	Eastern white pine, yellow-poplar, black walnut.
						Black oak	80	
						White oak	75	
Haney:								
HaB	2o	Slight	Slight	Slight	Slight	White oak	75	Eastern white pine, white ash, black walnut, yellow-poplar.
						Northern red oak	80	
						Black walnut		
[1] HeB:								
Haney part	2o	Slight	Slight	Slight	Slight	White oak	75	Eastern white pine, white ash, black walnut, yellow-poplar.
						Northern red oak	80	

TABLE 3.—*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	Important trees	Site index	
Rawson part	2o	Slight	Slight	Slight	Slight	White oak Northern red oak	75 80	Eastern white pine, yellow-poplar, black walnut.
[1] HeC: Haney part	2o	Slight	Slight	Slight	Slight	White oak Northern red oak	75 80	Eastern white pine, white ash, black walnut, yellow-poplar.
Rawson part	2o	Slight	Slight	Slight	Slight	White oak Northern red oak	75 80	Eastern white pine, yellow-poplar, black walnut.
Haskins: HkA, HnA	2w	Slight	Moderate	Slight	Slight	White oak Northern red oak Pin oak	75 80 90	White ash, eastern white pine, yellow-poplar.
Hoytville: Hv	3w	Slight	Severe	Severe	Moderate	Northern red oak Pin oak White ash	72 71 77	Red maple, white spruce, white ash.
Kibbie: KlA, KlB	2w	Slight	Moderate	Slight	Slight	Pin oak Northern red oak White ash	90 --- ---	Eastern white pine, yellow-poplar, Norway spruce.
Lamson: La	4w	Slight	Severe	Severe	Severe	Red maple Pin oak Swamp white oak Eastern cottonwood	50 70 --- ---	Eastern cottonwood, red maple.
Landes: Lb	1o	Slight	Slight	Slight	Slight	Eastern cottonwood Yellow-poplar American sycamore White ash Black walnut Black cherry Hackberry American basswood	105 95 --- --- --- --- --- ---	Eastern cottonwood, yellow-poplar, white ash, black walnut, eastern white pine.
Latty: Lc	3w	Slight	Severe	Severe	Severe	Swamp white oak Pin oak Red maple White ash	70 75 --- ---	White spruce, white ash, red maple.
Lenawee: Lf	2w	Slight	Severe	Severe	Moderate	Pin oak Northern red oak Swamp white oak Red maple White ash American sycamore Eastern cottonwood	85 75 --- --- --- --- ---	Norway spruce, red maple, white ash, white spruce.
Lucas: LuB2, LuC2	3c	Slight	Moderate	Moderate	Slight	Northern red oak White ash Red maple Pin oak	70 --- --- ---	Eastern white pine, yellow-poplar.

TABLE 3.—*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	Important trees	Site index	
LuD2	3c	Moderate	Severe	Moderate	Slight	Northern red oak White ash Red maple Pin oak	70 --- --- ---	Eastern white pine, yellow-poplar.
Martisco:								
Ma	5w	Slight	Severe	Severe	Severe	Red maple	55	
Mermill:								
Md	2w	Slight	Severe	Severe	Severe	Pin oak Swamp white oak White ash	90 90 ---	White ash, red maple.
Millgrove:								
Mh, Mk	2w	Slight	Severe	Severe	Severe	Pin oak Northern red oak Swamp white oak	85 80 85	White ash, red maple.
Nappanee:								
NnA, NnB, NpA	3w	Slight	Moderate	Moderate	Slight	Pin oak Northern red oak White ash	80[1] 70 ---	Eastern white pine, yellow-poplar, white ash.
Oshtemo:								
OrB, OrC, OsB	3s	Slight	Slight	Moderate	Slight	Northern red oak White oak American basswood Sugar maple	70 --- --- ---	Eastern white pine, red pine.
Ottokee:								
OtB	3s	Slight	Slight	Moderate	Slight	Northern red oak White oak	70 65	Eastern white pine, red pine.
Paulding:								
Pa	3w	Slight	Severe	Severe	Severe	Swamp white oak Pin oak White ash Red maple	65 76 --- ---	White ash, red maple.
Pewamo:								
Pm	2w	Slight	Severe	Severe	Severe	Red maple American basswood Pin oak Silver maple Bur oak White ash Eastern cottonwood Swamp white oak	66 --- 85 --- --- --- --- ---	White ash, white spruce, Norway spruce, red maple.
Rawson:								
RlB, RlC, RmB, RmC	2o	Slight	Slight	Slight	Slight	White oak Northern red oak	75 80	Eastern white pine, yellow-poplar, black walnut.
Rimer:								
RnA	2w	Slight	Moderate	Slight	Slight	Northern red oak White oak Red maple	80 75 ---	Eastern white pine, white ash, yellow-poplar.
Roselms:								
RsA, RsB	4w	Slight	Moderate	Severe	Severe	Swamp white oak Red maple White ash	60 --- ---	Red maple, white ash.

TABLE 3.—*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	Important trees	Site index	
St. Clair:								
SbB2, SbC2	3c	Slight	Slight	Moderate	Slight	Northern red oak	66	Eastern white pine, yellow-poplar.
						White oak	62	
						White ash	--------	
						Sugar maple	--------	
SbD2	3c	Moderate	Moderate	Moderate	Slight	Northern red oak	66	Eastern white pine, yellow-poplar.
						White oak	62	
						White ash	--------	
						Sugar maple	--------	
Seward:								
SdB	2o	Slight	Slight	Slight	Slight	Northern red oak	80	Eastern white pine, yellow-poplar, black walnut.
						Yellow-poplar	95	
						Black walnut	--------	
Shinrock:								
SgB, SgC	2o	Slight	Slight	Slight	Slight	Northern red oak	80	Eastern white pine, yellow-poplar, black walnut.
						Pin oak	85	
						Yellow-poplar	90	
						Sugar maple	80	
						Black walnut	--------	
Shoals:								
Sh	2w	Slight	Moderate	Slight	Slight	Pin oak	90	Yellow-poplar, white ash.
						Black walnut	--------	
						White ash	--------	
						Eastern cottonwood	--------	
						American sycamore	--------	
Sloan:								
Sn, So	2w	Slight	Severe	Severe	Severe	Pin oak	85	Eastern cottonwood, red maple.
						Swamp white oak	--------	
						Red maple	--------	
Spinks:								
SpB, SpC	3s	Slight	Slight	Moderate	Slight	Northern red oak	70	Eastern white pine, red pine.
						White oak	65	
Toledo:								
To	3w	Slight	Severe	Severe	Severe	Pin oak	80	White ash, red maple.
						Swamp white oak	80	
Tuscola variant:								
TuB, TuC	1o	Slight	Slight	Slight	Slight	Northern red oak	85	Eastern white pine, yellow-poplar, black walnut.
						Black walnut	--------	
						White ash	--------	
Wallkill:								
Wc	4w	Slight	Severe	Severe	Severe	Pin oak	80	
						Red maple	65	
Wallkill variant:								
Wk	4w	Slight	Severe	Severe	Slight	Pin oak	80	
						Swamp white oak	--------	
						Red maple	--------	

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table 4 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 5, for sanitary facilities; and table 7, for water management. Table 6 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have different meanings in soil science and in engineering; the Glossary defines many of these terms.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 4. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, and open ditches. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 4 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation do not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and the large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 4 have an all-weather surface that can carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 5 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to

TABLE 4.—*Building site development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Arkport:					
ApB	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Moderate: low strength.
Belmore:					
BlB	Moderate: small stones.	Slight	Slight	Slight	Moderate: low strength.
Blount:					
BnA, BnB, BnB2, BoA, BoB.	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action, low strength.
Bono:					
Bp	Severe: wetness, too clayey.	Severe: low strength, wetness shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.
Boyer:					
BrB	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
BrC	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
BsD	Severe: cutbanks cave, slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Carlisle:					
Ca	Severe: floods, wetness, cutbanks cave.	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: wetness, frost action, excess humus.
Ceresco:					
Ce	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.
Cohoctah:					
Ch	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.
Colwood:					
Cp	Severe: wetness, cutbanks cave.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strenth.	Severe: wetness, frost action, low strength.
Del Rey:					
DeA, DeB, DfA, DfB	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action, low strength.
Digby:					
DgA, DmA	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action.
Edwards:					
Ed	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.
Eel:					
Ee	Severe: floods	Severe: floods	Severe: floods, wetness.	Severe: floods	Severe: floods, frost action.
Fulton:					
FsA, FsB, FuA, FuB	Severe: too clayey, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.
Genesee:					
Ge	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods.

TABLE 4.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Gilford:					
Gf	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness, frost action.
Glynwood:					
GlB, GlB2	Moderate: wetness, too clayey.	Moderate: wetness, shrink-swell.	Severe: wetness	Moderate: slope, shrink-swell, wetness.	Severe: frost action, low strength.
GlC, GlC2	Moderate: slope, wetness, too clayey.	Moderate: slope, shrink-swell, wetness.	Severe: wetness	Severe: slope	Severe: frost action, low strength.
GlD2, GlE2	Severe: slope	Severe: slope	Severe: wetness, slope.	Severe: slope	Severe: slope, frost action, low strength.
Haney:					
HaB	Moderate: wetness.	Moderate: wetness.	Severe: wetness	Moderate: wetness.	Severe: frost action.
[1] HeB:					
Haney part	Moderate: wetness.	Moderate: wetness.	Severe: wetness	Moderate: wetness.	Severe: frost action.
Rawson part	Moderate: wetness, too clayey.	Moderate: wetness.	Severe: wetness	Moderate: wetness.	Moderate: low strength.
[1] HeC:					
Haney part	Moderate: wetness, slope.	Moderate: slope, wetness.	Severe: wetness	Severe: slope	Severe: frost action.
Rawson part	Moderate: wetness, slope, too clayey.	Moderate: slope, wetness.	Severe: wetness	Severe: slope	Moderate: slope, low strength.
Haskins:					
HkA, HnA	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action, low strength.
Hoytville:					
Hv	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, low strength.
Kibbie:					
KlA, KlB	Severe: wetness, cutbanks cave.	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness, frost action.
Lamson:					
La	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness, frost action.
Landes:					
Lb	Severe: cutbanks cave, floods.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Latty:					
Lc	Severe: too clayey, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness, low strength.
Lenawee:					
Lf	Severe: wetness	Severe: low strength, wetness.	Severe: low strength, wetness.	Severe: low strength, wetness.	Severe: frost action, low strength, wetness.
Lucas:					
LuB2	Severe: too clayey	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
LuC2	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
LuD2	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, low strength, shrink-swell.

TABLE 4.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Martisco:					
Ma	Severe: wetness, excess humus, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Mermill:					
Md	Severe: wetness	Severe: wetness, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength, frost action.
Millgrove:					
Mh, Mk	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness, frost action.
Nappanee:					
NnA, NnB, NpA	Severe: too clayey, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.
Oshtemo:					
OrB, OsB	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Slight.
OrC	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
Ottokee:					
OtB	Severe: cutbanks cave.	Moderate: wetness.	Severe: wetness	Moderate: wetness.	Slight.
Paulding:					
Pa	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, low strength.
Pewamo:					
Pm	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action, wetness.
Rawson:					
RlB, RmB	Moderate: wetness, too clayey.	Moderate: wetness.	Severe: wetness	Moderate: slope, wetness.	Moderate: low strength.
RlC, RmC	Moderate: wetness, slope, too clayey.	Moderate: slope, wetness.	Severe: wetness	Severe: slope	Moderate: slope, low strength.
Rimer:					
RnA	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action.
Roselms:					
RsA, RsB	Severe: wetness, too clayey.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.
St. Clair:					
SbB2	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
SbC2	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
SbD2	Severe: too clayey, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
Seward:					
SdB	Severe: cutbanks cave.	Moderate: wetness.	Severe: wetness	Moderate: wetness, slope.	Moderate: frost action.
Shinrock:					
SgB	Moderate: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness	Moderate: slope, shrink-swell, wetness.	Severe: low strength, frost action.

TABLE 4.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Shinrock:					
SgC	Moderate: wetness, slope.	Moderate: slope, shrink-swell, wetness.	Severe: wetness	Severe: slope	Severe: low strength, frost action.
Shoals:					
Sh	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.
Sloan:					
Sn, So	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.
Spinks:					
SpB	Severe: cutbanks cave.	Slight	Slight	Moderate: slope	Slight.
SpC	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
Toledo:					
To	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.
Tuscola variant:					
TuB	Moderate: wetness.	Moderate: wetness.	Severe: wetness	Moderate: wetness.	Severe: frost action.
TuC	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: wetness	Severe: slope	Severe: frost action.
Udorthents:					
Ud.					
Urban land:					
Ur.					
Wallkill:					
Wc	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.
Wallkill variant:					
Wk	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

overcome that major soil reclamation, special design, or intensive maintenance is required. Soil suitability is rated by the terms *good, fair,* or *poor,* which, respectively, mean about the same as the terms *slight, moderate,* and *severe.*

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor

TABLE 5.—*Sanitary facilities*

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means 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
Arkport:					
ApB	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Fair: too sandy.
Belmore:					
BlB	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Good.
Blount:					
BnA, BoA	Severe: wetness, percs slowly.	Slight	Severe: wetness	Severe: wetness	Fair: too clayey.
BnB, BnB2, BoB	Severe: wetness, percs slowly.	Moderate: slope	Severe: wetness	Severe: wetness	Fair: too clayey.
Bono:					
Bp	Severe: percs slowly, wetness.	Severe: wetness	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey, wetness.
Boyer:					
BrB	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Fair: thin layer.
BrC	Moderate: slope	Severe: seepage, slope.	Severe: seepage	Severe: seepage	Fair: slope, thin layer.
BsD	Severe: slope	Severe: seepage, slope.	Severe: seepage	Severe: seepage, slope.	Poor: slope.
Carlisle:					
Ca	Severe: floods, wetness.	Severe: wetness, excess humus, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: excess humus, wetness, seepage.
Ceresco:					
Ce	Severe: floods, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Good.
Cohoctah:					
Ch	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Poor: wetness.
Colwood:					
Cp	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Poor: wetness.
Del Rey:					
DeA, DfA	Severe: percs slowly, wetness.	Slight	Severe: wetness	Severe: wetness	Fair: too clayey.
DeB, DfB	Severe: percs slowly, wetness.	Moderate: slope	Severe: wetness	Severe: wetness	Fair: too clayey.
Digby:					
DgA, DmA	Severe: wetness	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness	Fair: thin layer.
Edwards:					
Ed	Severe: floods, wetness.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, seepage.	Poor: excess humus, wetness, hard to pack.
Eel:					
Ee	Severe: floods, wetness.	Severe: floods	Severe: floods, wetness.	Severe: floods	Good.
Fulton:					
FsA, FuA	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
FsB, FuB	Severe: percs slowly, wetness.	Moderate: slope	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
Genesee:					
Ge	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Good.
Gilford:					
Gf	Severe: wetness	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.

TABLE 5.—*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
Glynwood:					
GlB, GlB2	Severe: percs slowly.	Moderate: slope	Moderate: too clayey, wetness.	Moderate: wetness.	Fair: too clayey.
GlC, GlC2	Severe: percs slowly.	Severe: slope	Moderate: too clayey, wetness.	Moderate: slope, wetness.	Fair: slope, too clayey.
GlD2	Severe: slope, percs slowly.	Severe: slope	Moderate: slope, too clayey, wetness.	Severe: slope	Poor: slope.
GlE2	Severe: slope, percs slowly.	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
Haney:					
HeB	Severe: wetness	Severe: seepage	Severe: seepage	Moderate: wetness.	Fair: thin layer.
[1] HeB:					
Haney part	Severe: wetness	Severe: seepage	Severe: seepage	Moderate: wetness.	Fair: thin layer.
Rawson part	Severe: percs slowly.	Moderate: slope	Moderate: too clayey, wetness.	Moderate: wetness.	Fair: thin layer.
[1] HeC:					
Haney part	Severe: wetness	Severe: seepage, slope.	Severe: seepage	Moderate: slope, wetness.	Fair: slope, thin layer.
Rawson part	Severe: percs slowly.	Severe: slope	Moderate: too clayey, wetness.	Moderate: slope, wetness.	Fair: slope, thin layer.
Haskins:					
HkA, HnA	Severe: percs slowly, wetness.	Severe: wetness	Severe: wetness, too clayey.	Severe: wetness	Fair: too clayey, thin layer.
Hoytville:					
Hv	Severe: wetness, percs slowly.	Severe: wetness	Severe: wetness, too clayey.	Severe: wetness	Poor: wetness, too clayey.
Kibbie:					
KlA, KlB	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Good.
Lamson:					
La	Severe: wetness	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
Landes:					
Lb	Severe: floods	Severe: seepage, floods.	Severe: seepage, floods.	Severe: Seepage, floods.	Good.
Latty:					
Lc	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness	Poor: too clayey, wetness.
Lenawee:					
Lf	Severe: percs slowly, wetness.	Severe: wetness	Severe: wetness	Severe: wetness	Poor: wetness.
Lucas:					
LuB2	Severe: percs slowly, wetness.	Moderate: slope	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
LuC2	Severe: percs slowly, wetness.	Severe: slope	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey.
LuD2	Severe: slope, percs slowly, wetness.	Severe: slope	Severe: too clayey.	Severe: slope	Poor: slope, too clayey.
Martisco:					
Ma	Severe: wetness, percs slowly, floods.	Severe: wetness, excess humus, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, excess humus.
Mermill:					
Md	Severe: percs slowly, wetness.	Severe: wetness	Severe: wetness, too clayey.	Severe: wetness	Poor: wetness.
Millgrove:					
Mh, Mk	Severe: wetness	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.

TABLE 5.—*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
Nappanee:					
NnA, NpA	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Moderate: wetness.	Poor: hard to pack, too clayey.
NnB	Severe: percs slowly, wetness.	Moderate: slope	Severe: too clayey, wetness.	Moderate: wetness.	Poor: hard to pack, too clayey.
Oshtemo:					
OrB, OsB	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Fair: too sandy.
OrC	Moderate: slope	Severe: seepage, slope.	Severe: seepage	Severe: seepage	Fair: slope, too sandy.
Ottokee:					
OtB	Severe: wetness	Severe: seepage	Severe: seepage	Severe: seepage	Fair: too sandy.
Paulding:					
Pa	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey, wetness.
Pewamo:					
Pm	Severe: percs slowly, wetness.	Severe: wetness	Severe: wetness	Severe: wetness	Poor: too clayey, wetness.
Rawson:					
RlB, RmB	Severe: percs slowly.	Moderate: slope	Moderate: too clayey, wetness.	Moderate: wetness.	Fair: thin layer.
RlC, RmC	Severe: percs slowly.	Severe: slope	Moderate: too clayey, wetness.	Moderate: slope, wetness.	Fair: slope, thin layer.
Rimer:					
RnA	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Fair: thin layer, too sandy.
Roselms:					
RsA	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
RsB	Severe: percs slowly, wetness.	Moderate: slope	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
St. Clair:					
SbB2	Severe: percs slowly.	Moderate: slope	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
SbC2	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Moderate: slope	Poor: too clayey.
SbD2	Severe: percs slowly, slope.	Severe: slope	Severe: too clayey.	Severe: slope	Poor: too clayey, slope.
Seward:					
SdB	Severe: percs slowly.	Severe: seepage	Severe: seepage	Severe: seepage	Fair: thin layer.
Shinrock:					
SgB	Severe: percs slowly.	Moderate: slope, wetness.	Moderate: too clayey, wetness.	Moderate: wetness.	Fair: too clayey.
SgC	Severe: percs slowly.	Severe: slope	Moderate: too clayey, wetness.	Moderate: slope, wetness.	Fair: slope, too clayey.
Shoals:					
Sh	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Sloan:					
Sn, So	Severe: wetness, floods, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Spinks:					
SpB	Slight	Severe: seepage	Severe: too sandy, seepage.	Severe: seepage	Poor: too sandy, seepage.
SpC	Moderate: slope	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage	Poor: too sandy, seepage.

TABLE 5.—*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
Toledo:					
To	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey, wetness.
Tuscola variant:					
TuB	Severe: wetness	Severe: wetness	Severe: wetness, seepage.	Moderate: wetness.	Good.
TuC	Severe: wetness	Severe: slope, wetness.	Severe: wetness, seepage.	Moderate: wetness, slope.	Fair: slope.
Udorthents:					
Ud.					
Urban land:					
Ur.					
Wallkill:					
Wc	Severe: floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: wetness.
Wallkill variant:					
Wk	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness.	Poor: wetness.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 5 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 6 by ratings of good, fair, or poor. The texture, thickness,

TABLE 6.—*Construction materials*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Arkport:				
ApB	Fair: low strength	Poor: excess fines	Unsuited: excess fines.	Poor: too sandy.
Belmore:				
BlB	Good	Poor: excess fines	Poor: excess fines	Fair: thin layer.
Blount:				
BnA, BnB, BnB2, BoA, BoB.	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: thin layer.
Bono:				
Bp	Poor: low strength, wetness, shrink-swell.	Unsuited	Unsuited	Poor: wetness, too clayey.
Boyer:				
BrB, BrC	Good	Good	Good	Poor: too sandy.
BsD	Fair: slope	Good	Good	Poor: too sandy, slope.
Carlisle:				
Ca	Poor: frost action, excess humus, low strength.	Unsuited	Unsuited	Poor: wetness.
Ceresco:				
Ce	Poor: frost action, wetness.	Poor: excess fines	Unsuited	Good.
Cohoctah:				
Ch	Poor: frost action, wetness.	Unsuited	Unsuited	Poor: wetness.
Colwood:				
Cp	Poor: wetness, frost action, low strength.	Unsuited	Unsuited	Poor: wetness.
Del Rey:				
DeA, DeB, DfA, DfB	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: thin layer.
Digby:				
DgA, DmA	Poor: frost action	Poor: excess fines	Unsuited: excess fines.	Fair: thin layer.
Edwards:				
Ed	Poor: frost action, excess humus, wetness.	Unsuited	Unsuited	Poor: wetness.
Eel:				
Ee	Poor: frost action	Unsuited	Unsuited	Good.
Fulton:				
FsA, FsB	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: thin layer.
FuA, FuB	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
Genesee:				
Ge	Poor: frost action, low strength.	Unsuited	Unsuited	Good.
Gilford:				
Gf	Poor: wetness, frost action.	Fair: excess fines	Unsuited	Poor: wetness.
Glynwood:				
GlB, GlB2	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: thin layer.

TABLE 6.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
GlC, GlC2	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: slope, thin layer.
GlD2	Poor: frost action, low strength.	Unsuited	Unsuited	Poor: slope.
GlE2	Poor: frost action, low strength, slope.	Unsuited	Unsuited	Poor: slope.
Haney:				
HaB	Poor: frost action	Poor: excess fines	Unsuited	Fair: thin layer.
[1] HeB:				
Haney part	Poor: frost action	Poor: excess fines	Unsuited	Fair: thin layer.
Rawson part	Poor: low strength, thin layer.	Unsuited	Unsuited	Fair: thin layer.
[1] HeC:				
Haney part	Poor: frost action	Poor: excess fines	Unsuited	Fair: thin layer, slope.
Rawson part	Poor: low strength, thin layer.	Unsuited	Unsuited	Fair: thin layer, slope.
Haskins:				
HkA, HnA	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: thin layer.
Hoytville:				
Hv	Poor: wetness, shrink-swell, low strength.	Unsuited	Unsuited	Poor: wetness.
Kibbie:				
KlA, KlB	Poor: frost action	Unsuited	Unsuited	Good.
Lamson:				
La	Poor: wetness, frost action.	Poor	Unsuited	Poor: wetness.
Landes:				
Lb	Fair: frost action	Fair: excess fines	Unsuited	Good.
Latty:				
Lc	Poor: low strength, wetness, shrink-swell.	Unsuited	Unsuited	Poor: wetness, too clayey.
Lenawee:				
Lf	Poor: wetness, frost action, low strength.	Unsuited	Unsuited	Poor: wetness.
Lucas:				
LuB2, LuC2	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: thin layer.
LuD2	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope.
Martisco:				
Ma	Poor: wetness, excess humus.	Unsuited	Unsuited	Poor: wetness.
Mermill:				
Md	Poor: low strength, wetness.	Unsuited	Unsuited	Poor: wetness.
Millgrove:				
Mh, Mk	Poor: wetness	Poor: excess fines	Poor: excess fines	Poor: wetness.
Nappanee:				
NnA, NnB, NpA	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: thin layer.
Oshtemo:				
OrB, OrC	Good	Fair: excess fines	Fair: excess fines	Poor: too sandy.
OsB	Good	Fair: excess fines	Fair: excess fines	Good.
Ottokee:				
OtB	Good	Fair: excess fines	Unsuited	Poor: too sandy.

TABLE 6.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Paulding:				
Pa	Poor: low strength, shrink-swell, wetness.	Unsuited	Unsuited	Poor: wetness, too clayey.
Pewamo:				
Pm	Poor: frost action, low strength, wetness.	Unsuited	Unsuited	Poor: wetness.
Rawson:				
RlB, RmB	Poor: low strength, thin layer.	Unsuited	Unsuited	Fair: thin layer.
RlC, RmC	Poor: low strength, thin layer.	Unsuited	Unsuited	Fair: thin layer, slope.
Rimer:				
RnA	Poor: thin layer	Poor: excess fines	Unsuited	Poor: too sandy.
Roselms:				
RsA, RsB	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: too clayey.
St. Clair:				
SbB2	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey, thin layer.
SbC2	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: slope, too clayey, thin layer.
SbD2	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.
Seward:				
SdB	Poor: thin layer	Poor: excess fines	Unsuited	Poor: too sandy.
Shinrock:				
SgB	Poor: low strength	Unsuited	Unsuited	Fair: thin layer.
SgC	Poor: low strength	Unsuited	Unsuited	Fair: slope, thin layer.
Shoals:				
Sh	Poor: frost action	Unsuited	Unsuited	Good.
Sloan:				
Sn, So	Poor: wetness, frost action.	Unsuited	Unsuited	Poor: wetness.
Spinks:				
SpB, SpC	Good	Good	Unsuited	Poor: too sandy, thin layer.
Toledo:				
To	Poor: low strength, wetness, shrink-swell.	Unsuited	Unsuited	Poor: wetness, too clayey.
Tuscola variant:				
TuB	Poor: frost action	Unsuited	Unsuited	Fair: thin layer.
TuC	Poor: frost action	Unsuited	Unsuited	Fair: slope, thin layer.
Udorthents:				
Ud.				
Urban land:				
Ur.				
Wallkill:				
Wc	Poor: low strength, frost action, wetness.	Unsuited	Unsuited	Poor: wetness.
Wallkill variant:				
Wk	Poor: low strength, wetness, frost action.	Unsuited	Unsuited	Poor: wetness.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 7.—*Water management*

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Arkport: ApB	Seepage, slope.	Seepage, piping.	Not needed	Fast intake, seepage, slope.	Not needed	Droughty.
Belmore: BlB	Seepage	Piping, seepage.	Not needed	Erodes easily, slope.	Favorable	Slope.
Blount: BnA, BnB, BnB2, BoA, BoB.	Favorable	Favorable	Percs slowly	Wetness, slow intake.	Percs slowly, wetness.	Erodes easily, wetness.
Bono: Bp	Favorable	Low strength, shrink-swell.	Percs slowly	Wetness, percs slowly.	Wetness	Wetness.
Boyer: BrB, BrC, BsD	Seepage	Seepage	Not needed	Seepage, fast intake.	Complex slope, soil blowing.	Droughty.
Carlisle: Ca	Seepage	Excess humus	Wetness, cutbanks cave, poor outlets.	Soil blowing, fast intake, wetness.	Not needed	Not needed.
Ceresco: Ce	Seepage	Erodes easily, piping, unstable fill.	Poor outlets, floods.	Floods, wetness.	Not needed	Not needed.
Cohoctah: Ch	Seepage	Piping	Poor outlets, floods, wetness.	Wetness, floods.	Not needed	Not needed.
Colwood: Cp	Seepage	Low strength, piping, erodes easily.	Cutbanks cave, wetness.	Wetness	Not needed	Erodes easily, wetness.
Del Rey: DeA, DeB, DfA, DfB	Favorable	Low strength	Percs slowly	Slow intake, wetness.	Percs slowly, wetness.	Wetness.
Digby: DgA, DmA	Seepage	Seepage	Favorable	Wetness	Wetness	Wetness.
Edwards: Ed	Seepage	Compressible, hard to pack, low strength.	Wetness, cutbanks cave, poor outlets.	Floods, soil blowing, wetness.	Not needed	Not needed.
Eel: Ee	Seepage	Piping, low strength.	Not needed	Floods	Not needed	Not needed.
Fulton: FsA, FsB, FuA, FuB	Favorable	Low strength, shrink-swell, hard to pack.	Percs slowly, wetness.	Slow intake, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
Genesee: Ge	Seepage	Piping, low strength, erodes easily.	Not needed	Floods	Not needed	Not needed.
Gilford: Gf	Seepage	Seepage	Cutbanks cave	Wetness	Not needed	Favorable.

TABLE 7.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Glynwood:						
GlB, GlB2	Favorable	Hard to pack, shrink-swell.	Percs slowly	Percs slowly	Percs slowly	Percs slowly.
GlC, GlC2, GlD2, GlE2	Slope	Hard to pack, shrink-swell.	Percs slowly	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
Haney:						
HaB	Seepage	Seepage	Not needed	Slope	Favorable	Favorable.
[1] HeB:						
Haney part	Seepage	Seepage	Not needed	Slope	Favorable	Favorable.
Rawson part	Favorable	Low strength	Not needed	Slope	Favorable	Favorable.
[1] HeC:						
Haney part	Seepage	Seepage	Not needed	Slope	Favorable	Favorable.
Rawson part	Favorable	Low strength	Not needed	Slope	Favorable	Favorable.
Haskins:						
HkA, HnA	Favorable	Low strength	Favorable	Wetness	Wetness	Wetness.
Hoytville:						
Hv	Favorable	Low strength	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Kibbie:						
KlA, KlB	Seepage	Erodes easily, unstable fill, piping.	Wetness, cutbanks cave.	Wetness	Not needed	Erodes easily.
Lamson:						
La	Seepage	Piping, unstable fill.	Wetness, poor outlets, piping.	Wetness	Not needed	Not needed.
Landes:						
Lb	Seepage	Seepage, piping.	Not needed	Complex slope, droughty.	Favorable	Not needed.
Latty:						
Lc	Favorable	Low strength, compressible, hard to pack.	Percs slowly, wetness.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Lenawee:						
Lf	Favorable	Low strength	Percs slowly, wetness.	Percs slowly, wetness.	Not needed	Percs slowly, wetness.
Lucas:						
LuB2, LuC2, LuD2	Slope	Low strength, compressible, hard to pack.	Percs slowly	Erodes easily, slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly, erodes easily.
Martisco:						
Ma	Favorable	Low strength	Percs slowly, poor outlets, wetness.	Wetness	Not needed	Not needed.
Mermill:						
Md	Favorable	Low strength	Favorable	Wetness	Wetness	Wetness.
Millgrove:						
Mh, Mk	Seepage	Seepage	Favorable	Wetness	Wetness	Wetness.
Nappanee:						
NnA, NnB, NpA	Favorable	Shrink-swell, hard to pack, low strength.	Percs slowly	Slow intake, percs slowly.	Percs slowly, wetness.	Percs slowly, wetness.
Oshtemo:						
OrB, OsB	Seepage	Piping, seepage.	Not needed	Seepage, fast intake.	Complex slope	Droughty, slope.
OrC	Seepage	Piping, seepage.	Not needed	Seepage, fast intake, slope.	Complex slope	Droughty, slope.

TABLE 7.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ottokee:						
OtB	Seepage	Seepage, unstable fill.	Not needed	Fast intake, slope.	Too sandy, soil blowing.	Droughty.
Paulding:						
Pa	Favorable	Low strength, compressible, hard to pack.	Percs slowly, wetness.	Wetness, percs slowly.	Wetness	Wetness, percs slowly.
Pewamo:						
Pm	Favorable	Low strength, shrink-swell.	Percs slowly, poor outlets, wetness.	Slow intake, percs slowly, wetness.	Not needed	Percs slowly, wetness.
Rawson:						
RlB, RlC, RmB, RmC	Favorable	Low strength	Not needed	Slope	Favorable	Favorable.
Rimer:						
RnA	Favorable	Seepage, piping.	Favorable	Fast intake, wetness.	Too sandy, wetness.	Wetness.
Roselms:						
RsA, RsB	Favorable	Low strength, shrink-swell, hard to pack.	Percs slowly	Wetness, slow intake.	Wetness, percs slowly.	Wetness. percs slowly.
St. Clair:						
SbB2	Favorable	Shrink-swell, hard to pack, compressible.	Not needed	Percs slowly, complex slope, erodes easily.	Complex slope, percs slowly, erodes easily.	Percs slowly, erodes easily.
SbC2, SbD2	Slope	Shrink-swell, hard to pack, compressible.	Not needed	Percs slowly, complex slope, erodes easily.	Complex slope, percs slowly, erodes easily.	Percs slowly, slope, erodes easily.
Seward:						
SdB	Favorable	Piping	Favorable	Fast intake, slope.	Piping, too sandy.	Droughty.
Shinrock:						
SgB	Favorable	Low strength, shrink-swell.	Not needed	Percs slowly, slope.	Percs slowly	Percs slowly, erodes easily.
SgC	Slope	Low strength, shrink-swell.	Not needed	Percs slowly, slope.	Erodes easily, slope, percs slowly.	Slope, percs slowly, erodes easily.
Shoals:						
Sh	Seepage	Piping, low strength.	Floods, wetness.	Wetness, floods.	Not needed	Not needed.
Sloan:						
Sn, So	Favorable	Piping	Wetness, floods, poor outlets.	Wetness, floods.	Not needed	Wetness.
Spinks:						
SpB, SpC	Seepage	Seepage	Not needed	Droughty, fast intake, seepage.	Too sandy, complex slope, soil blowing.	Droughty.
Toledo:						
To	Favorable	Low strength, compressible, hard to pack.	Percs slowly, wetness.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Tuscola variant:						
TuB, TuC	Seepage, slope.	Low strength, erodes easily, piping.	Not needed	Slope, erodes easily.	Erodes easily, piping.	Erodes easily.
Udorthents:						
Ud.						

TABLE 7.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Urban land: Ur.						
Wallkill: Wc	Seepage	Low strength	Wetness, poor outlets.	Wetness	Not needed	Not needed.
Wallkill variant: Wk	Favorable	Low strength, hard to pack, unstable fill.	Wetness, poor outlets.	Wetness	Wetness	Wetness.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of constrasting suitability within their profile. The estimated engineering properties in table 10 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 12 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 6 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 10.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 7 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.

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; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or 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, hardpan, 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.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 8 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 5, and interpretations for dwellings without basements and for local roads and streets, given in table 4.

Camp areas require such site preparation as shaping and leveling for 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 for this use 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife Habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

TABLE 8.—*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 means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Arkport:				
ApB	Moderate: too sandy	Moderate: too sandy	Moderate: slope, too sandy.	Moderate: too sandy.
Belmore:				
BlB	Slight	Slight	Moderate: slope	Slight.
Blount:				
BnA, BoA	Moderate: wetness, percs slowly.	Moderate: wetness	Moderate: percs slowly, wetness.	Moderate: wetness.
BnB, BnB2, BoB	Moderate: wetness, percs slowly.	Moderate: wetness	Moderate: percs slowly, wetness, slope.	Moderate: wetness.
Bono:				
Bp	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Boyer:				
BrB	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy.
BrC	Moderate: too sandy	Moderate: too sandy	Severe: slope	Moderate: too sandy.
BsD	Severe: slope	Severe: slope	Severe: slope	Moderate: too sandy.
Carlisle:				
Ca	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus, floods.
Ceresco:				
Ce	Severe: wetness, floods.	Moderate: floods, wetness.	Severe: wetness	Slight.
Cohoctah:				
Ch	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Colwood:				
Cp	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Del Rey:				
DeA, DfA	Moderate: wetness, percs slowly.	Moderate: wetness	Moderate: wetness, percs slowly.	Moderate: wetness.
DeB, DfB	Moderate: wetness, percs slowly.	Moderate: wetness	Moderate: slope, wetness, percs slowly.	Moderate: wetness.
Digby:				
DgA, DmA	Moderate: wetness	Moderate: wetness	Moderate: wetness	Moderate: wetness.
Edwards:				
Ed	Severe: dusty, wetness, excess humus.	Severe: dusty, wetness, excess humus.	Severe: dusty, wetness, excess humus.	Severe: dusty, wetness, excess humus.
Eel:				
Ee	Severe: floods	Moderate: floods	Severe: floods	Moderate: floods.
Fulton:				
FsA, FsB, FuA, FuB	Severe: percs slowly, wetness.	Moderate: wetness	Severe: percs slowly, wetness.	Moderate: wetness.
Genesee:				
Ge	Severe: floods	Moderate: floods	Severe: floods	Moderate: floods.
Gilford:				
Gf	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Glynwood:				
GlB, GlB2	Moderate: percs slowly.	Slight	Moderate: wetness, percs slowly.	Slight.
GlC, GlC2	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
GlD2	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
GlE2	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 8.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Haney:				
HaB	Slight	Slight	Moderate: slope	Slight.
[1] HeB:				
Haney part	Slight	Slight	Moderate: slope	Slight.
Rawson part	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
[1] HeC:				
Haney part	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Rawson part	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
Haskins:				
HkA, HnA	Severe: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness.
Hoytville:				
Hv	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Kibbie:				
KlA, KlB	Severe: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness.
Lamson:				
La	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Landes:				
Lb	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Latty:				
Lc	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Lenawee:				
Lf	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Lucas:				
LuB2	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, slope, too clayey.	Moderate: too clayey.
LuC2	Moderate: percs slowly, slope.	Moderate: slope	Severe: slope	Moderate: too clayey.
LuD2	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Martisco:				
Ma	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Mermill:				
Md	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Millgrove:				
Mh, Mk	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Nappanee:				
NnA, NnB, NpA	Severe: percs slowly, wetness.	Moderate: wetness	Severe: percs slowly, wetness.	Moderate: wetness.
Oshtemo:				
OrB	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy, slope.	Moderate: too sandy.
OrC	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope	Moderate: too sandy.
OsB	Slight	Slight	Moderate: slope	Slight.
Ottokee:				
OtB	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy.
Paulding:				
Pa	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Pewamo:				
Pm	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.

TABLE 8.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Rawson:				
RlB, RmB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
RlC, RmC	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
Rimer:				
RnA	Severe: wetness	Moderate: wetness	Severe: wetness too sandy.	Moderate: wetness.
Roselms:				
RsA, RsB	Severe: wetness, percs slowly, too clayey.	Severe: too clayey	Severe: wetness, percs slowly, too clayey.	Severe: too clayey.
St. Clair:				
SbB2	Severe: percs slowly	Moderate: too clayey	Severe: percs slowly	Moderate: too clayey.
SbC2	Severe: percs slowly	Moderate: too clayey, slope.	Severe: percs slowly, slope.	Moderate: too clayey.
SbD2	Severe: percs slowly, slope.	Severe: slope	Severe: percs slowly, slope.	Moderate: too clayey, slope.
Seward:				
SdB	Moderate: too sandy	Moderate: too sandy	Moderate: slope, too sandy.	Moderate: too sandy.
Shinrock:				
SgB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
SgC	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
Shoals:				
Sh	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: wetness, floods.	Moderate: wetness, floods.
Sloan:				
Sn, So	Severe: wetness, floods.	Severe: wetness	Severe: wetness, floods.	Severe: wetness.
Spinks:				
SpB	Moderate: too sandy	Moderate: too sandy	Moderate: slope, too sandy.	Moderate: too sandy.
SpC	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope	Moderate: too sandy.
Toledo:				
To	Severe: too clayey, wetness.	Severe: too clayey, wetness.	Severe: too clayey, wetness.	Severe: too clayey, wetness.
Tuscola variant:				
TuB	Slight	Slight	Moderate: slope	Slight.
TuC	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Udorthents:				
Ud	Moderate: percs slowly, too clayey.	Moderate: too clayey	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.
Urban land:				
Ur.				
Wallkill:				
Wc	Severe: floods, wetness.	Severe: wetness	Severe: wetness	Severe: wetness.
Wallkill variant:				
Wk	Severe: floods, wetness.	Severe: wetness	Severe: wetness	Severe: wetness.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 9.—*Wildlife*

[See text for definitions of "good," "fair," "poor," and "very

Soil name and map symbol	Potential for habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Arkport:				
ApB	Fair	Good	Good	Good
Belmore:				
BlB	Fair	Good	Good	Good
Blount:				
BnA, BoA	Fair	Good	Good	Good
BnB, BnB2, BoB	Fair	Good	Good	Good
Bono:				
Bp	Poor	Poor	Poor	Poor
Boyer:				
BrB, BrC, BsD	Poor	Fair	Good	Good
Carlisle:				
Ca	Poor	Poor	Poor	Poor
Ceresco:				
Ce	Fair	Good	Good	Good
Cohoctah:				
Ch	Poor	Poor	Poor	Poor
Colwood:				
Cp	Fair	Poor	Poor	Poor
Del Rey:				
DeA, DfA	Fair	Good	Good	Good
DeB, DfB	Fair	Good	Good	Good
Digby:				
DgA, DmA	Fair	Good	Good	Good
Edwards:				
Ed	Poor	Poor	Poor	Poor
Eel:				
Ee	Poor	Fair	Fair	Good
Fulton:				
FsA, FuA	Fair	Good	Good	Good
FsB, FuB	Fair	Good	Good	Good
Genesee:				
Ge	Poor	Fair	Fair	Good
Gilford:				
Gf	Fair	Poor	Poor	Poor
Glynwood:				
GlB, GlB2	Good	Good	Good	Good
GlC, GlC2	Fair	Good	Good	Good
GlD2	Poor	Fair	Good	Good
GlE2	Verp poor	Fair	Good	Good
Haney:				
HaB	Good	Good	Good	Good
[1] HeB:				
Haney part	Good	Good	Good	Good
Rawson part	Good	Good	Good	Good
[1] HeC:				
Haney part	Fair	Good	Good	Good
Rawson part	Fair	Good	Good	Good
Haskins:				
HkA, HnA	Fair	Good	Good	Good

habitat potentials

poor." Absence of an entry indicates the soil was not rated]

Potential for habitat elements—Continued			Potential as habitat for—		
Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Fair	Fair	Good	Good	Fair.
Poor	Good	Good	Poor	Poor	Good.
Poor	Good	Good	Poor	Poor	Good.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Poor	Fair	Good	Poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Fair	Good	Poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.

TABLE 9.—*Wildlife habitat*

Soil name and map symbol	Potential for habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Hoytville:				
Hv	Poor	Poor	Poor	Poor
Kibbie:				
KlA	Good	Good	Good	Good
KlB	Good	Good	Good	Good
Lamson				
La	Very poor	Poor	Poor	Poor
Landes:				
Lb	Good	Good	Good	Good
Latty:				
Lc	Poor	Poor	Poor	Poor
Lenawee:				
Lf	Poor	Poor	Poor	Poor
Lucas:				
LuB2	Fair	Good	Good	Good
LuC2	Fair	Good	Good	Good
LuD2	Poor	Fair	Good	Good
Martisco:				
Ma	Very poor	Poor	Very poor	Very poor
Mermill:				
Md	Fair	Fair	Poor	Poor
Millgrove:				
Mh, Mk	Poor	Poor	Poor	Poor
Nappanee:				
NnA, NpA	Good	Good	Good	Good
NnB	Good	Good	Good	Good
Oshtemo:				
OrB, OrC	Poor	Fair	Good	Good
OsB	Good	Good	Good	Good
Ottokee:				
OtB	Poor	Fair	Good	Fair
Paulding:				
Pa	Poor	Poor	Poor	Poor
Pewamo:				
Pm	Poor	Poor	Poor	Poor
Rawson:				
RlB, RmB	Good	Good	Good	Good
RlC, RmC	Fair	Good	Good	Good
Rimer:				
RnA	Poor	Fair	Good	Good
Roselms:				
RsA	Fair	Good	Good	Good
RsB	Fair	Good	Good	Good
St. Clair:				
SbB2	Good	Good	Good	Good
SbC2	Fair	Good	Good	Good
SbD2	Poor	Fair	Good	Good
Seward:				
SdB	Fair	Good	Good	Fair

potentials—Continued

Potential for habitat elements—Continued			Potential as habitat for—		
Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Poor	Good	Good	Poor	Poor	Good.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Poor	Good	Good	Poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Very poor	Good	Good	Very poor	Very poor	Good.
Poor	Good	Good	Fair	Poor	Good.
Poor	Good	Good	Poor	Poor	Good.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Poor	Good	Good	Poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Fair	Good	Fair.
Good	Fair	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Poor	Very poor	Good	Fair	Very poor.

TABLE 9.—*Wildlife habitat*

Soil name and map symbol	Potential for habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Shinrock:				
SgB	Good	Good	Good	Good
SgC	Fair	Good	Good	Good
Shoals:				
Sh	Poor	Fair	Fair	Good
Sloan:				
Sn, So	Poor	Poor	Poor	Poor
Spinks:				
SpB	Poor	Fair	Good	Fair
SpC	Poor	Fair	Good	Fair
Toledo:				
To	Poor	Poor	Poor	Poor
Tuscola variant:				
TuB	Good	Good	Good	Good
TuC	Fair	Good	Good	Good
Udorthents:				
Ud.				
Urban land:				
Ur.				
Wallkill:				
Wc	Very poor	Poor	Poor	Poor
Wallkill variant:				
Wk	Very poor	Poor	Poor	Poor

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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 (*1*). A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties 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 that are planted for wildlife food and cover. Major soil properties 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

potentials—Continued

Potential for habitat elements—Continued			Potential as habitat for—		
Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Fair	Good	Fair.
Poor	Good	Good	Poor	Poor	Good.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Good	Good	Poor	Poor	Good.

slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties 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 foxtail, ragweed, goldenrod, smartweed, panicgrass, and grama.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, and blackberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants 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, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are duckweed, wild millet, and willows and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples

of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat 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 kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

Soil Properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering Properties

Table 10 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of constrasting properties. Table 10 gives information for each of these contrasting horizons in a typical profile. Depth to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Descriptions of the soils."

Texture is described in table 10 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*2*).

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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL–ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A–1 are coarse grained and low in content of fines. At the other extreme, in group A–7, are fine-grained soils. Highly organic soils are classified in group A–8 on the basis of visual inspection.

When laboratory data are available, the A–1, A–2, and A–7 groups are further classified as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 13. The estimated classification, without group index numbers, is given in table 10. Also in table 10 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in

diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and Chemical Properties

Table 11 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships between the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the planning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A *high* shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion, as used in table 11, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

Soil and Water Features

Table 12 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils 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 is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of

TABLE 10.—*Engineering*

[The symbol < means less than; > means more than.

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Arkport:				
ApB	0–10	Loamy fine sand	SM	A–2, A–4
	10–24	Very fine sandy loam, loamy very fine sand, loamy fine sand.	SM, ML	A–2, A–4
	24–79	Very fine sand, loamy fine sand, loamy very fine sand.	SM, ML	A–2, A–4
	79–89	Loamy fine sand, fine sand, loamy very fine sand.	SM	A–2, A–4
Belmore:				
BlB	0–15	Sandy loam	ML, SM	A–4
	15–45	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A–6
	45–72	Gravelly sandy loam, gravelly loam, sandy loam.	SM, SC	A–2, A–4
Blount:				
BnA, BnB, BnB2, BoA, BoB	0–8	Loam	ML, CL, CL–ML	A–6, A–4
	8–31	Silty clay loam, silty clay, clay loam	CH, CL	A–7, A–6
	31–60	Silty clay loam, clay loam	CL	A–6
Bono:				
Bp	0–12	Silty clay loam	CH, CL	A–7
	12–36	Silty clay, clay, silty clay loam	CH, CL	A–7
	36–68	Silty clay, clay, silty clay loam	CH, CL	A–7
Boyer:				
BrB, BrC	0–19	Loamy sand	SM, SM–SC	A–2
	19–31	Sandy loam, sandy clay loam, loamy sand.	SM, SC, SM–SC	A–2, A–4, A–6
	31–60	Stratified sand to gravel	SP, SP–SM, GP, GP–GM	A–1, A–3, A–2–4
BsD	0–19	Gravelly loamy sand	SM, SM–SC	A–2
	19–31	Sandy loam, sandy clay loam, loamy sand.	SM, SC, SM–SC	A–2, A–4, A–6
	31–60	Stratified sand to gravel	SP, SP–SM, GP, GP–GM	A–1, A–3, A–2–4
Carlisle:				
Ca	0–66	Sapric material	Pt	A–8
Ceresco:				
Ce	0–10	Sandy loam	SM, ML	A–2, A–4
	10–60	Sandy loam, loamy fine sand	SM, ML	A–2, A–4
Cohoctah:				
Ch	0–12	Loam	ML	A–4
	12–60	Loam, fine sandy loam, sandy loam	ML, SM, SC, CL	A–4, A–2
Colwood:				
Cp	0–14	Silt loam	ML, CL, CL–ML	A–4
	14–49	Loam, silty clay loam, silt loam	CL, CL–ML	A–6, A–4
	49–60	Stratified silt loam to fine sand	SM–SC, SM, ML	A–2, A–4
Del Rey:				
DeA, DeB	0–10	Loam	CL, ML	A–6, A–4
	10–46	Silty clay loam, silty clay	CH, CL	A–7
	46–66	Silt loam, silty clay loam	CL, ML	A–6, A–7
DfA, DfB	0–10	Silty clay loam	CL	A–6
	10–46	Silty clay loam, silty clay	CH, CL	A–7
	46–66	Silt loam, silty clay loam	CL	A–6, A–7
Digby:				
DgA	0–12	Sandy loam	SM, ML	A–4
	12–37	Clay loam, sandy clay loam, gravelly loam.	CL, SC, CL–ML, SM–SC	A–6, A–4
	37–60	Stratified gravelly sandy loam to gravelly sand.	SM, SW–SM, SP–SM	A–4, A–2, A–1

properties and classifications

Absence of an entry means data were not estimated]

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	90–100	90–100	65–85	20–45	----------	NP
0	90–100	90–100	70–95	30–65	<15	NP–4
0	90–100	90–100	65–95	20–60	----------	NP
0	90–100	90–100	60–95	15–50	----------	NP
0	85–100	80–100	60–90	35–55	16–36	NP–10
0	85–100	80–100	55–75	40–70	10–36	10–20
0	80–100	65–90	40–65	10–40	10–30	NP–10
0–5	95–100	95–100	90–100	70–95	25–40	8–15
0–5	95–100	90–100	90–100	75–95	35–60	15–35
0–10	90–100	90–100	80–100	70–90	25–40	10–25
0	100	100	95–100	80–95	40–60	20–35
0	100	100	95–100	90–100	40–66	26–44
0	100	100	90–100	70–100	40–60	24–40
0–5	95–100	65–95	45–75	15–30	<20	NP–6
0–5	80–100	65–95	55–85	10–45	10–35	NP–16
0–10	40–100	35–100	30–70	0–10	----------	NP
0–5	95–100	65–95	45–75	15–30	<20	NP–6
0–5	80–100	65–95	55–85	10–45	10–35	NP–16
0–10	40–100	35–100	30–70	0–10	----------	NP
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0	100	100	60–90	30–55	10–20	NP–6
0	80–100	80–100	60–85	15–60	10–30	NP–8
0	100	100	75–95	55–75	20–30	NP–6
0	95–100	85–100	70–90	30–70	<30	NP–10
0	100	100	85–100	60–90	18–40	2–9
0	100	100	80–100	50–90	20–40	6–20
0	100	95–100	70–100	30–80	<35	NP–10
0	95–100	95–100	90–98	75–95	25–50	5–20
0	95–100	95–100	90–100	70–95	35–55	15–30
0	95–100	95–100	90–100	70–95	30–50	5–25
0	95–100	95–100	90–98	75–95	25–40	11–20
0	95–100	95–100	90–100	70–95	35–55	15–30
0	95–100	95–100	90–100	70–95	30–50	11–25
0	85–100	80–100	50–90	40–55	<30	NP–4
0	85–100	70–100	55–75	40–70	25–40	4–16
0–5	80–100	65–90	40–65	10–40	<30	NP–4

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
DmA	0–12	Loam	ML	A–4
	12–37	Clay loam, sandy clay loam, gravelly loam.	CL, SC, CL–ML, SM–SC	A–6, A–4
	37–60	Stratified gravelly sandy loam to gravelly sand.	SM, SW–SM, SP–SM	A–4, A–2, A–1
Edwards:				
Ed	0–27	Sapric material	Pt	A–8
	27–60	Marl		
Eel:				
Ee	0–8	Loam	ML, CL	A–4, A–6
	8–34	Silt loam, loam	ML, CL	A–4, A–6
	34–64	Stratified sandy loam to silty clay loam.	ML, CL	A–4, A–6
Fulton:				
FsA, FsB	0–8	Loam	CL, ML	A–4, A–6
	8–37	Silty clay, clay	CH, CL	A–7
	37–62	Silty clay, clay	CH, CL	A–7
FuA, FuB	0–8	Silty clay loam	CL	A–7, A–6
	8–37	Silty clay, clay	CH, CL	A–7
	37–62	Silty clay, clay	CH, CL	A–7
Genesee:				
Ge	0–8	Loam	ML, CL	A–4, A–6
	8–40	Silt loam, loam	ML, CL	A–4, A–6
	40–60	Stratified sandy loam to silt loam	ML, CL	A–4, A–6
Gilford:				
Gf	0–11	Fine sandy loam	SM, SC, SM–SC	A–4
	11–39	Sandy loam	SM, SC, SM–SC	A–2–4
	39–49	Loamy sand, sand	SM, SP, SP–SM	A–3, A–1–b
	49–60	Silty clay loam, clay	CL, CH	A–6, A–7
Glynwood:				
GlB, GlB2, GlC, GlC2, GlD2, GlE2	0–8	Loam	ML, CL–ML, CL	A–4, A–6
	8–32	Clay, clay loam, silty clay loam	CL, CH	A–7, A–6
	32–60	Clay loam, silty clay loam	CL	A–6, A–4
Haney:				
HeB	0–13	Loam	ML	A–4
	13–34	Clay loam, sandy clay loam, gravelly loam.	CL, SC, ML, SM	A–6, A–4
	34–60	Stratified gravelly sandy loam to gravel.	SM, SW–SM, SP–SM	A–1, A–4, A–2
[1] HeB:				
Haney part	0–13	Sandy loam	ML, SM, SC, CL	A–2, A–4, A–6
	13–34	Clay loam, sandy clay loam, gravelly loam.	CL, SC, ML, SM	A–6, A–4
	34–60	Stratified gravelly sandy loam to gravel.	SM, SW–SM, SP–SM	A–1, A–4, A–2
Rawson part	0–13	Sandy loam	SM, ML	A–2–4, A–4
	13–34	Clay loam, sandy clay loam, gravelly sandy clay loam.	SC, CL	A–4, A–6
	34–60	Clay, silty clay, silty clay loam	CH, CL	A–7, A–6
[1] HeC:				
Haney part	0–13	Sandy loam	ML, SM, SC, CL	A–2, A–4, A–6
	13–34	Clay loam, sandy clay loam, gravelly loam.	CL, SC, ML, SM	A–6, A–4
	34–60	Stratified gravelly sandy loam to gravel.	SM, SW–SM, SP–SM	A–1, A–4, A–2
Rawson part	0–13	Sandy loam	SM, ML	A–2–4, A–4
	13–34	Clay loam, sandy clay loam, gravelly sandy clay loam.	SC, CL	A–4, A–6
	34–60	Clay, silty clay, silty clay loam	CH, CL	A–7, A–6

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	85–100	80–100	70–90	60–80	20–36	NP–10
0	85–100	70–100	55–75	40–70	25–40	4–16
0–5	80–100	65–90	40–65	10–40	<30	NP–4
0	----------	----------	----------	----------	----------	----------
0	100	95–100	80–90	60–80	----------	----------
0	100	100	90–100	75–85	26–40	5–15
0	100	100	90–100	75–85	26–40	5–15
0	100	90–100	70–80	55–70	26–40	5–15
0	100	100	90–100	70–100	35–40	10–16
0	100	100	90–100	85–100	40–60	18–34
0	100	100	90–100	85–100	40–60	18–34
0	100	100	90–100	80–100	35–50	14–24
0	100	100	90–100	85–100	40–60	18–34
0	100	100	90–100	85–100	40–60	18–34
0	100	100	90–100	75–85	26–40	5–15
0	100	100	90–100	75–85	26–40	5–15
0	100	90–100	70–80	50–70	26–40	5–15
0	95–100	90–100	65–80	35–45	16–22	2–10
0	90–100	90–100	55–70	25–35	20–30	2–8
0	90–100	85–100	18–60	3–18	----------	NP
0	95–100	90–100	90–100	75–95	32–55	18–34
0	95–100	95–100	85–100	55–90	23–40	2–16
0–5	95–100	90–100	85–100	80–95	35–55	15–30
0–5	95–100	85–100	80–95	65–85	25–40	7–18
0	85–100	80–95	70–90	50–80	20–36	NP–10
0	80–100	75–95	55–75	40–70	25–40	3–16
0–5	80–100	65–90	40–65	10–40	<30	NP–4
0	85–100	80–95	70–90	30–55	<30	NP–15
0	80–100	75–95	55–75	40–70	25–40	3–16
0–5	80–100	65–90	40–65	10–40	<30	NP–4
0	95–100	90–100	60–85	30–55	----------	NP
0	85–100	75–100	60–85	35–65	20–40	7–20
0	100	90–100	90–100	80–95	35–65	15–40
0	85–100	80–95	70–90	30–55	<30	NP–15
0	80–100	75–95	55–75	40–70	25–40	3–16
0–5	80–100	65–90	40–65	10–40	<30	NP–4
0	95–100	90–100	60–85	30–55	----------	NP
0	85–100	75–100	60–85	35–65	20–40	7–20
0	100	90–100	90–100	80–95	35–65	15–40

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Haskins:				
HkA	0–13	Sandy loam	SM, ML	A–4
	13–26	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A–6, A–4
	26–63	Clay, silty clay, clay loam	CH, CL	A–7, A–6
HnA	0–13	Loam	CL–ML, CL	A–4, A–6
	13–26	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A–6, A–4
	26–63	Clay, silty clay, clay loam	CH, CL	A–7, A–6
Hoytville:				
Hv	0–8	Clay	CH, CL	A–6, A–7
	8–50	Clay, silty clay	CH, CL	A–7
	50–60	Clay	CH, CL	A–7
Kibbie:				
KlA, KlB	0–13	Very fine sandy loam	SM, ML, SM–SC, CL–ML	A–4
	13–42	Silt loam, silty clay loam	CL, CL–ML	A–4, A–6
	42–60	Stratified silt loam to fine sand	ML, SM, SC, CL	A–4, A–2
Lamson:				
La	0–13	Very fine sandy loam	SM, ML, OL	A–4
	13–32	Fine sandy loam, very fine sandy loam, fine sand.	SM, ML	A–4, A–2
	32–60	Stratified fine sand to silt loam	SM, ML	A–2, A–4
Landes:				
Lb	0–11	Sandy loam	SM, ML	A–4
	11–60	Stratified fine sand to silt loam	SM, ML, SC, SW–SM	A–2, A–4, A–3
Latty:				
Lc	0–9	Silty clay	MH, CH	A–7
	9–53	Clay, silty clay	CH	A–7
	53–69	Clay, silty clay	CH	A–7
Lenawee:				
Lf	0–10	Silty clay loam	CL	A–6, A–7
	10–46	Silty clay loam, silty clay	CL, CH	A–6, A–7
	46–62	Silt loam, silty clay loam	CL	A–6, A–4, A–7
Lucas:				
LuB2, LuC2, LuD2	0–8	Silty clay loam	CL, ML	A–6, A–7
	8–39	Silty clay, clay	CH, CL	A–7
	39–60	Silty clay, clay	CH, CL	A–7
Martisco:				
Ma	0–10	Sapric material	Pt	A–8
	10–37	Marl		
	37–70	Loam, silt loam	ML, CL	A–4, A–6
Mermill:				
Md	0–9	Loam	ML	A–4
	9–28	Sandy clay loam, clay loam, sandy clay.	SC, CL	A–6, A–7, A–4
	28–60	Clay, silty clay, clay loam	CH, CL	A–7, A–6
Millgrove:				
Mh	0–11	Loam	ML, CL–ML, CL	A–4, A–6
	11–31	Clay loam, sandy clay loam	CL, SC	A–6
	31–60	Gravelly sandy loam, gravelly loam	SM, ML, GM	A–2, A–4
Mk	0–11	Clay loam	ML, CL–ML, CL	A–4, A–6
	11–31	Clay loam, sandy clay loam	CL, SC	A–6
	31–60	Gravelly sandy loam, gravelly loam	SM, ML, GM	A–2, A–4

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	95–100	90–100	85–95	35–55	<30	NP–5
0	85–100	75–100	60–85	40–65	20–40	7–20
0	100	90–100	90–100	80–95	35–65	15–40
0	95–100	90–100	85–95	50–65	25–40	5–20
0	85–100	75–100	60–85	40–65	20–40	7–20
0	100	90–100	90–100	80–95	35–65	15–40
0	100	90–100	85–100	80–100	36–66	15–40
0	100	90–100	85–100	80–100	42–66	22–40
0	100	90–100	85–100	80–100	40–62	22–40
0	100	100	75–95	40–60	18–25	2–7
0	100	100	90–100	70–90	18–40	6–20
0	100	95–100	70–95	30–80	<30	NP–10
0	95–100	90–100	70–90	40–85	<20	NP–4
0	95–100	80–100	52–90	25–55	<20	NP–4
0	95–100	80–100	60–90	20–70	<20	NP–4
0	100	95–100	85–95	36–55	25–40	NP–10
0	100	95–100	60–95	3–70	<30	NP–10
0	95–100	90–100	85–100	80–100	50–80	20–44
0	95–100	90–100	85–100	80–100	50–70	28–44
0	95–100	90–100	85–100	80–100	50–70	28–44
0	100	95–100	95–100	85–95	25–45	11–22
0	100	95–100	90–100	80–95	25–55	11–30
0	100	95–100	95–100	85–95	25–45	6–22
0	100	100	90–100	80–95	35–50	10–25
0	100	100	90–100	80–95	40–60	18–34
0	100	100	90–100	80–95	40–60	18–34
0						
0						
0	100	100	75–100	60–90	20–40	3–18
0	95–100	90–100	80–100	55–85	28–40	4–10
0	90–100	80–100	70–85	40–75	24–44	8–22
0	100	90–100	90–100	80–95	38–65	18–40
0	95–100	90–100	85–100	55–85	25–40	3–16
0	90–100	85–100	70–95	40–75	20–40	11–28
0–5	65–90	45–85	40–70	30–55	16–36	NP–10
0	95–100	90–100	85–100	55–85	25–40	3–16
0	90–100	85–100	70–95	40–75	20–40	11–28
0–5	65–90	45–85	40–70	30–55	16–36	NP–10

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Nappanee:				
NnA, NnB	0–8	Loam	ML, CL	A–4
	8–38	Silty clay, clay	CL, CH	A–6, A–7
	38–60	Silty clay, clay, clay loam	CL, CH	A–6, A–7
NpA	0–8	Silty clay loam	CL	A–4, A–6
	8–38	Silty clay, clay	CL, CH	A–6, A–7
	38–60	Silty clay, clay, clay loam	CL, CH	A–6, A–7
Oshtemo:				
OrB, OrC	0–17	Loamy sand	SM	A–2
	17–52	Sandy loam, sandy clay loam	SM, SC	A–2, A–4, A–6
	52–76	Stratified coarse sand to gravel	SP–SM, GP	A–1
OsB	0–17	Sandy loam	SM	A–2, A–4
	17–52	Sandy loam, sandy clay loam	SM, SC	A–2, A–4, A–6
	52–76	Stratified coarse sand to gravel	SP–SM, GP	A–1
Ottokee:				
OtB	0–9	Fine sand	SM	A–2
	9–50	Loamy fine sand, fine sand, loamy sand.	SM	A–2
	50–80	Fine sand, sand	SM, SW–SM, SP–SM	A–2
Paulding:				
Pa	0–6	Clay	CH	A–7
	6–53	Clay	CH	A–7
	53–61	Clay	CH	A–7
Pewamo:				
Pm	0–11	Silty clay loam	CL	A–6
	11–46	Clay loam, clay, silty clay	CL, CH	A–6, A–7
	46–72	Clay loam, silty clay loam	CL	A–6, A–7
Rawson:				
RlB, RlC	0–13	Sandy loam	SM, ML	A–2–4, A–4
	13–34	Clay loam, sandy clay loam, gravelly sandy clay loam.	SC, CL	A–4, A–6
	34–60	Clay, silty clay, silty clay loam	CH, CL	A–7, A–6
RmB, RmC	0–13	Loam	CL–ML, CL, ML	A–4, A–6
	13–34	Clay loam, sandy clay loam, gravelly sandy clay loam.	SC, CL	A–4, A–6
	34–60	Clay, silty clay, silty clay loam	CH, CL	A–7, A–6
Rimer:				
RnA	0–9	Loamy fine sand	SM	A–2, A–4
	9–21	Loamy fine sand, fine sand, loamy sand.	SM	A–2, A–4
	21–24	Fine sandy loam, sandy loam	SM, SM–SC, SC	A–4
	24–63	Clay, silty clay, silty clay loam	CH, CL	A–7
Roselms:				
RsA, RsB	0–8	Silty clay	CH, MH, CL	A–7, A–6
	8–32	Clay	CH, MH	A–7
	32–60	Clay	CH	A–7
St. Clair:				
SbB2, SbC2, SbD2	0–5	Silty clay loam	CL	A–4, A–6
	5–21	Clay, silty clay	CH	A–7
	21–60	Clay, silty clay	CH	A–7
Seward:				
SdB	0–23	Loamy fine sand	SM	A–2, A–4
	23–25	Fine sandy loam, sandy loam	SM	A–2, A–4
	25–60	Clay, silty clay, silty clay loam	CH, CL	A–7

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0–5	95–100	90–100	85–100	55–90	15–40	5–10
0–5	95–100	90–100	85–100	70–95	25–70	10–42
0–5	95–100	90–100	85–100	70–95	25–60	10–34
0–5	95–100	90–100	85–100	70–95	25–40	5–15
0–5	95–100	90–100	85–100	70–95	25–70	10–42
0–5	95–100	90–100	85–100	70–95	25–60	10–34
0	95–100	60–95	40–70	15–30	----------	NP
0	95–100	60–95	60–85	25–45	12–30	2–16
----------	40–90	35–85	20–60	0–10	----------	NP
0	95–100	60–95	60–70	25–40	12–25	2–7
0	95–100	60–95	60–85	25–45	12–30	2–16
----------	40–90	35–85	20–60	0–10	----------	NP
0	100	90–100	80–95	20–35	----------	NP
0	100	90–100	80–95	20–35	----------	NP
0	100	95–100	80–90	10–25	----------	NP
0	95–100	95–100	90–100	90–100	50–80	25–50
0	95–100	95–100	90–100	90–100	50–78	25–50
0	95–100	95–100	90–100	90–100	50–80	30–45
0–5	95–100	90–100	90–100	70–90	25–40	10–20
0–5	95–100	90–100	90–100	75–95	35–55	15–30
0–5	95–100	90–100	90–100	70–90	30–45	14–25
0	95–100	90–100	60–85	30–55	----------	NP
0	85–100	75–100	60–85	35–65	20–40	7–20
0	100	90–100	90–100	80–95	35–65	15–40
0	95–100	85–100	75–100	60–90	25–40	4–16
0	85–100	75–100	60–85	35–65	20–40	7–20
0	100	90–100	90–100	80–95	35–65	15–40
0	100	95–100	75–90	20–40	----------	NP
0	100	95–100	75–90	20–40	----------	NP
0	100	95–100	60–80	35–50	15–30	NP–10
0	100	95–100	90–100	80–95	40–65	20–38
0	95–100	95–100	90–100	90–100	35–65	18–32
0	95–100	95–100	90–100	90–100	50–75	24–40
0	95–100	95–100	90–100	90–100	50–75	24–45
0–5	95–100	90–100	80–100	60–95	27–37	9–16
0–5	95–100	90–100	75–100	65–95	50–70	25–41
0–5	95–100	90–100	70–100	60–95	50–60	29–34
0	100	95–100	65–80	15–40	----------	NP
0	100	90–100	60–80	25–40	<40	NP–10
0	100	90–100	90–100	80–95	40–65	20–38

TABLE 10.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Shinrock:				
SgB, SgC	0–8	Silt loam	ML, CL–ML, CL	A–4, A–6
	8–26	Silty clay loam, silty clay, clay	CH, CL	A–7
	26–60	Stratified silty clay loam to fine sandy loam.	CL, ML, SM	A–7, A–4, A–6
Shoals:				
Sh	0–8	Loam	CL, CL–ML	A–4, A–6
	8–36	Silt loam	ML, CL, CL–ML	A–4, A–6
	36–60	Stratified silt loam to sandy loam	ML	A–4
Sloan:				
Sn	0–11	Loam	CL, ML	A–6, A–4
	11–22	Silty clay loam, clay loam, silt loam	CL, ML	A–6, A–7, A–4
	22–60	Stratified loam to silty clay loam	ML, CL	A–4, A–6
So	0–11	Silty clay loam	CL	A–6, A–7
	11–22	Silty clay loam, clay loam, silt loam	CL, ML	A–6, A–7, A–4
	22–60	Stratified loam to silty clay loam	ML, CL	A–4, A–6
Spinks:				
SpB, SpC	0–22	Fine sand	SP–SM, SM	A–2–4, A–3
	22–98	Stratified fine sand to loamy fine sand	SM	A–2–4
	98	Fine sand	SP–SM, SM	A–2–4, A–3
Toledo:				
To	0–9	Silty clay	CH, MH, CL	A–7
	9–44	Silty clay, clay	CH, CL	A–7
	44–64	Silty clay, clay	CH, CL	A–7
Tuscola variant:				
TuB, TuC	0–9	Fine sandy loam	SM, ML	A–4
	9–31	Loam, sandy clay loam, silt loam	ML, SC, CL	A–4, A–6
	31–60	Stratified very fine sandy loam to silt loam.	ML, SM	A–4
Udorthents:				
Ud.				
Urban land:				
Ur.				
Wallkill:				
Wc	0–7	Silt loam	ML, CL	A–4
	7–20	Silt loam, loam	ML, CL	A–4
	20–60	Sapric material	Pt	A–8
Wallkill variant:				
Wk	0–8	Silty clay loam	CL	A–6, A–7
	8–32	Silty clay, silty clay loam	CH, CL	A–7
	32–60	Sapric material, coprogenous earth	Pt	A–8

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior

flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 12 are the depth to the seasonal high water table; the

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	85–100	65–90	20–35	2–12
0	100	100	95–100	80–95	35–55	14–32
0	100	100	75–100	40–95	<42	NP–20
0	100	100	90–100	65–90	22–36	6–15
0	100	100	90–100	75–85	25–35	4–11
0–3	95–100	90–100	70–80	55–70	32–40	3–8
0	100	95–100	85–100	70–80	30–40	8–15
0	100	90–100	85–100	75–95	30–45	8–18
0	95–100	90–100	80–95	65–90	25–40	8–15
0	100	95–100	85–100	80–95	30–45	10–18
0	100	90–100	85–100	75–95	30–45	8–18
0	95–100	90–100	80–95	65–90	25–40	8–15
0	100	80–100	50–70	5–20	----------	NP
0	100	80–100	60–85	10–30	----------	NP
0	100	80–100	50–80	5–25	----------	NP
0	100	100	95–100	80–95	40–65	18–32
0	100	100	95–100	90–100	40–60	18–32
0	100	100	95–100	90–100	40–65	18–36
0	100	100	70–90	40–60	20–35	2–9
0	100	100	80–100	40–90	20–40	3–18
0	100	95–100	75–100	40–95	<25	NP–4
0	95–100	90–100	70–100	55–90	10–20	1–10
0	95–100	75–100	75–100	55–90	10–20	1–10
0	----------	----------	----------	----------	----------	----------
0	95–100	95–100	85–100	80–95	35–50	16–28
0	95–100	95–100	85–100	80–95	40–60	20–34
0	----------	----------	----------	----------	----------	----------

of the whole map unit.

kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

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 attach-

TABLE 11.—*Physical and chemical properties of soils*

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion	
						Uncoated steel	Concrete
	In	*In/hr*	*In/in*	*pH*			
Arkport:							
ApB	0–10	2.0–6.0	0.08–0.09	5.6–6.5	Low	Low	Moderate.
	10–24	2.0–6.0	0.06–0.16	5.1–6.5	Low	Low	Moderate.
	24–79	2.0–6.0	0.06–0.12	5.1–7.3	Low	Low	Moderate.
	79–89	2.0–6.0	0.02–0.06	6.6–8.4	Low	Low	Moderate.
Belmore:							
BlB	0–15	2.0–6.0	0.14–0.18	6.1–7.3	Low	Moderate	Moderate.
	15–45	2.0–6.0	0.10–0.14	6.1–7.8	Low	Moderate	Moderate.
	45–72	6.0–20	0.08–0.12	7.4–8.4	Low	Moderate	Low.
Blount:							
BnA, BnB, BnB2, BoA, BoB	0–8	0.6–2.0	0.18–0.22	5.1–7.3	Low	High	Moderate.
	8–31	0.06–0.6	0.12–0.18	5.1–8.4	Moderate	High	High.
	31–60	0.06–0.6	0.07–0.10	7.4–8.4	Moderate	High	Low.
Bono:							
Bp	0–12	0.2–2.0	0.20–0.28	6.1–7.3	High	High	Low.
	12–36	<0.2	0.10–0.14	7.4–8.4	High	High	Low.
	36–68	<0.2	0.08–0.12	7.4–8.4	High	High	Low.
Boyer:							
BrB, BrC, BsD	0–19	6.0–20	0.10–0.12	5.6–7.3	Low	Low	Moderate.
	19–31	2.0–6.0	0.12–0.18	5.6–7.3	Low	Low	Moderate.
	31–60	>20	0.02–0.04	7.4–8.4	Low	Low	Low.
Carlisle:							
Ca	0–66	0.2–6.0	0.35–0.45	5.6–7.8		High	Low.
Ceresco:							
Ce	0–10	2.0–6.0	0.13–0.22	6.1–7.8	Low	Low	Low.
	10–60	0.6–6.0	0.08–0.13	6.1–8.4	Low	Low	Low.
Cohoctah:							
Ch	0–12	2.0–6.0	0.13–0.22	6.1–7.8	Low	High	Low.
	12–60	2.0–6.0	0.12–0.20	6.1–8.4	Low	High	Low.
Colwood:							
Cp	0–14	0.6–2.0	0.20–0.24	6.1–7.8	Low	High	Low.
	14–49	0.6–2.0	0.17–0.22	6.1–8.4	Low	High	Low.
	49–60	0.6–2.0	0.12–0.22	7.4–8.4	Low	High	Low.
Del Rey:							
DeA, DeB, DfA, DfB	0–10	0.6–2.0	0.18–0.22	5.1–6.5	Low	High	Moderate.
	10–46	0.06–0.2	0.12–0.20	6.1–8.4	Moderate	High	Low.
	46–66	0.06–0.2	0.09–0.11	7.9–8.4	Moderate	High	Low.
Digby:							
DgA	0–12	2.0–6.0	0.10–0.13	5.6–7.3	Low	Moderate	Moderate.
	12–37	0.6–2.0	0.12–0.16	6.1–7.8	Low	Moderate	Moderate.
	37–60	6.0–20	0.02–0.06	7.4–8.4	Low	Moderate	Low.
DmA	0–12	0.6–2.0	0.13–0.16	5.6–7.3	Low	Moderate	Moderate.
	12–37	0.6–2.0	0.12–0.16	6.1–7.8	Low	Moderate	Moderate.
	37–60	6.0–20	0.02–0.06	7.4–8.4	Low	Moderate	Low.
Edwards:							
Ed	0–27	0.2–6.0	0.35–0.45	5.6–7.8		High	Low.
	27–60			7.4–8.4		High	Low.
Eel:							
Ee	0–8	0.6–2.0	0.20–0.24	6.6–7.8	Low	Moderate	Low.
	8–34	0.6–2.0	0.17–0.22	6.6–8.4	Low	Moderate	Low.
	34–60	0.6–2.0	0.14–0.21	7.4–8.4	Low	Moderate	Low.
Fulton:							
FsA, FsB, FuA, FuB	0–8	0.6–2.0	0.16–0.19	5.6–7.3	Moderate	High	Moderate.
	8–37	0.06–0.2	0.12–0.16	6.6–7.8	High	High	Moderate.
	37–62	<0.2	0.08–0.12	7.4–8.4	High	High	Low.

TABLE 11.—*Physical and chemical properties of soils*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion	
						Uncoated steel	Concrete
	In	*In/hr*	*In/in*	*pH*			
Genesee:							
Ge	0–8	0.6–2.0	0.20–0.24	6.6–7.8	Low	Low	Low.
	8–40	0.6–2.0	0.17–0.22	6.6–8.4	Low	Low	Low.
	40–60	0.6–2.0	0.19–0.21	7.4–8.4	Low	Low	Low.
Gilford:							
Gf	0–11	2.0–6.0	0.16–0.18	6.1–6.5	Low	High	Moderate.
	11–39	2.0–6.0	0.12–0.14	6.1–7.8	Low	High	Moderate.
	39–49	6.0–20	0.05–0.08	7.4–8.4	Low	High	Low.
	49–60	0.06–0.2	0.05–0.10	7.4–8.4	Low	High	Low.
Glynwood:							
GlB, GlB2, GlC, GlC2, GlD2, GlE2.	0–8	0.6–2.0	0.15–0.19	5.6–7.3	Low	Moderate	Moderate.
	8–32	0.06–0.2	0.11–0.15	5.1–8.4	Moderate	High	Moderate.
	32–60	0.06–0.2	0.08–0.12	7.4–8.4	Low	High	Low.
Haney:							
HaB	0–13	0.6–2.0	0.14–0.16	5.6–7.3	Low	Moderate	Moderate.
	13–34	0.6–2.0	0.12–0.16	5.6–7.8	Low	Moderate	High.
	34–60	6.0–20	0.02–0.06	7.4–8.4	Low	Moderate	Low.
[1] HeB:							
Haney part	0–13	2.0–6.0	0.10–0.12	5.6–7.3	Low	Moderate	High.
	13–34	0.6–2.0	0.12–0.16	5.6–7.8	Low	Moderate	High.
	34–60	6.0–20	0.02–0.06	7.4–8.4	Low	Moderate	Low.
Rawson part	0–13	0.6–2.0	0.13–0.18	5.6–7.3	Low	Moderate	High.
	13–34	0.6–2.0	0.12–0.16	5.6–7.3	Low	High	Moderate.
	34–60	<0.2	0.08–0.14	6.6–8.4	High	High	Low.
[1] HeC:							
Haney part	0–13	2.0–6.0	0.10–0.12	5.6–7.3	Low	Moderate	High.
	13–34	0.6–2.0	0.12–0.16	5.6–7.8	Low	Moderate	High.
	34–60	6.0–20	0.02–0.06	7.4–8.4	Low	Moderate	Low.
Rawson part	0–13	0.6–2.0	0.13–0.18	5.6–7.3	Low	Moderate	High.
	13–34	0.6–2.0	0.12–0.16	5.6–7.3	Low	High	Moderate.
	34–60	<0.2	0.08–0.14	6.6–8.4	High	High	Low.
Haskins:							
HkA	0–13	0.6–2.0	0.14–0.16	5.1–7.3	Low	High	Moderate.
	13–26	0.6–2.0	0.12–0.16	5.6–7.8	Low	High	Moderate.
	26–63	<0.2	0.08–0.14	6.6–8.4	High	High	Low.
HnA	0–13	0.6–2.0	0.16–0.18	5.1–7.3	Low	High	Moderate.
	13–26	0.6–2.0	0.12–0.16	5.6–7.8	Low	High	Moderate.
	26–63	<0.2	0.08–0.14	6.6–8.4	High	High	Low.
Hoytville:							
Hv	0–8	0.6–2.0	0.14–0.17	6.1–7.3	High	High	Low.
	8–50	0.2–0.6	0.11–0.15	6.1–8.4	High	High	Low.
	50–60	0.06–0.2	0.10–0.14	6.6–8.4	High	High	Low.
Kibbie:							
KlA, KlB	0–13	0.6–2.0	0.16–0.20	5.6–7.3	Low	High	Moderate.
	13–42	0.6–2.0	0.17–0.22	5.6–8.4	Low	High	Moderate.
	42–60	0.6–2.0	0.12–0.22	7.4–8.4	Low	High	Low.
Lamson:							
La	0–13	0.6–6.0	0.12–0.16	5.6–7.3	Low	High	Low.
	13–32	0.6–2.0	0.11–0.13	6.1–8.4	Low	High	Low.
	32–60	0.6–6.0	0.04–0.12	7.4–8.4	Low	High	Low.
Landes:							
Lb	0–11	2.0–6.0	0.13–0.17	6.1–7.8	Low	Low	Low.
	11–60	6.0–20	0.05–0.17	6.1–8.4	Low	Low	Low.
Latty:							
Lc	0–9	0.06–0.2	0.14–0.18	6.1–7.3	High	High	Low.
	9–53	0.06–0.2	0.12–0.16	6.6–7.8	High	High	Low.
	53–69	<0.06	0.10–0.14	7.4–8.4	High	High	Low.

TABLE 11.—*Physical and chemical properties of soils*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion	
						Uncoated steel	Concrete
	In	*In/hr*	*In/in*	*pH*			
Lenawee:							
Lf	0–10	0.6–2.0	0.20–0.22	5.6–7.3	Moderate	High	Low.
	10–46	0.2–0.6	0.18–0.20	6.1–7.8	Moderate	High	Low.
	46–62	0.6–2.0	0.18–0.22	7.4–8.4	Low	High	Low.
Lucas:							
LuB2, LuC2, LuD2	0–8	0.2–0.6	0.16–0.19	5.1–7.3	Moderate	High	Moderate.
	8–39	0.06–0.2	0.12–0.14	5.1–7.3	High	High	Moderate.
	39–60	<0.2	0.08–0.12	7.4–8.4	High	High	Low.
Martisco:							
Ma	0–10	0.6–6.0	0.25–0.35	6.1–7.8	Low	High	Low.
	10–37	0.06–0.2	----------	7.9–8.4	Low	High	Low.
	37–70	0.06–0.6	0.14–0.18	7.9–8.4	Low	High	Low.
Mermill:							
Md	0–9	0.6–2.0	0.16–0.20	5.6–7.3	Low	High	Low.
	9–28	0.6–2.0	0.12–0.16	6.1–7.3	Moderate	High	Low.
	28–60	<0.06	0.08–0.14	6.6–8.4	High	High	Low.
Millgrove:							
Mh, Mk	0–11	0.6–2.0	0.16–0.22	5.6–7.3	Moderate	High	Low.
	11–31	0.6–2.0	0.12–0.16	6.1–7.8	Moderate	High	Low.
	31–60	2.0–6.0	0.08–0.12	7.4–8.4	Low	High	Low.
Nappanee:							
NnA, NnB	0–8	0.6–2.0	0.20–0.24	5.6–7.3	Low	Moderate	Low.
	8–38	<0.06	0.10–0.14	5.6–7.8	High	High	Low.
	38–60	<0.06	0.08–0.12	7.4–8.4	High	High	Low.
NpA	0–8	0.2–0.6	0.18–0.20	5.6–7.3	Moderate	Moderate	Low.
	8–38	<0.06	0.10–0.14	5.6–7.8	High	High	Low.
	38–60	<0.06	0.08–0.12	7.4–8.4	High	High	Low.
Oshtemo:							
OrB, OrC	0–17	6.0–20	0.08–0.12	5.6–6.5	Low	Low	High.
	17–52	2.0–6.0	0.10–0.14	5.6–6.5	Low	Low	High.
	52–76	>20	0.02–0.04	7.4–8.4	Low	Low	Low.
OsB	0–17	2.0–6.0	0.10–0.15	5.6–6.5	Low	Low	High.
	17–52	2.0–6.0	0.10–0.14	5.6–6.5	Low	Low	High.
	52–76	>20	0.02–0.04	7.4–8.4	Low	Low	Low.
Ottokee:							
OtB	0–9	6.0–20	0.06–0.08	5.6–7.3	Low	Low	Low.
	9–50	6.0–20	0.06–0.08	5.6–7.3	Low	Low	Low.
	50–80	6.0–20	0.03–0.06	6.6–8.4	Low	Moderate	Low.
Paulding:							
Pa	0–6	0.06–0.2	0.14–0.22	5.6–7.3	High	High	Low.
	6–53	<0.06	0.10–0.14	5.6–7.8	High	High	Low.
	53–61	<0.06	0.08–0.12	7.4–7.8	High	High	Low.
Pewamo:							
Pm	0–11	0.6–2.0	0.17–0.22	5.6–7.3	Moderate	High	Low.
	11–46	0.2–0.6	0.12–0.20	6.1–7.8	Moderate	High	Low.
	46–72	0.2–0.6	0.14–0.18	7.4–8.4	Moderate	High	Low.
Rawson:							
RlB, RlC	0–13	0.6–2.0	0.13–0.18	5.6–7.3	Low	Moderate	High.
	13–34	0.6–2.0	0.12–0.16	5.6–7.8	Low	High	Moderate.
	34–60	<0.2	0.08–0.14	6.6–8.4	High	High	Low.
RmB, RmC	0–13	0.6–2.0	0.18–0.22	5.6–7.3	Low	Moderate	High.
	13–34	0.6–2.0	0.12–0.16	5.6–7.8	Low	High	Moderate.
	34–60	<0.2	0.08–0.14	6.6–8.4	High	High	Low.

TABLE 11.—*Physical and chemical properties of soils*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion	
						Uncoated steel	Concrete
	In	*In/hr*	*In/in*	*pH*			
Rimer:							
RnA	0–9	6.0–20.0	0.08–0.14	5.6–7.3	Low	Moderate	Moderate.
	9–21	6.0–20.0	0.06–0.10	5.1–7.3	Low	Moderate	Moderate.
	21–24	2.0–6.0	0.10–0.14	5.1–7.3	Low	Moderate	Moderate.
	24–63	<0.06	0.06–0.10	6.1–7.8	High	High	Low.
Roselms:							
RsA, RsB	0–8	0.06–0.2	0.11–0.16	5.1–6.5	High	High	Moderate.
	8–32	<0.06	0.09–0.13	5.1–7.8	High	High	Moderate.
	32–60	<0.06	0.08–0.12	7.4–8.4	High	High	Low.
St. Clair:							
SbB2, SbC2, SbD2	0–5	0.2–2.0	0.17–0.23	5.6–7.3	Moderate	Moderate	Moderate.
	5–21	<0.2	0.10–0.12	5.6–7.3	High	High	Moderate.
	21–60	<0.2	0.09–0.11	7.4–8.4	High	High	Low.
Seward:							
SdB	0–23	>6.0	0.06–0.10	5.6–7.3	Low	Low	Moderate.
	23–25	>6.0	0.10–0.14	6.1–7.3	Low	Low	Moderate.
	25–60	<0.06	0.06–0.10	6.1–8.4	High	High	Low.
Shinrock:							
SgB, SgC	0–8	0.6–2.0	0.18–0.22	5.6–7.3	Low	Moderate	Low.
	8–26	0.2–0.6	0.10–0.16	5.6–7.8	Moderate	High	Moderate.
	26–60	0.2–2.0	0.10–0.18	7.4–8.4	Moderate	High	Low.
Shoals:							
Sh	0–8	0.6–2.0	0.22–0.24	6.1–7.8	Low	High	Low.
	8–36	0.6–2.0	0.20–0.22	6.6–7.8	Low	High	Low.
	36–60	0.6–2.0	0.19–0.21	6.6–8.4	Low	High	Low.
Sloan:							
Sn, So	0–11	0.6–2.0	0.20–0.24	6.1–7.8	Moderate	High	Low.
	11–22	0.2–2.0	0.15–0.19	6.1–7.8	Moderate	High	Low.
	22–60	0.2–2.0	0.13–0.18	7.4–8.4	Low	High	Low.
Spinks:							
SpB, SpC	0–22	6.0–20	0.06–0.08	5.6–7.3	Low	Low	Low.
	22–98	2.0–20	0.04–0.08	5.6–7.8	Low	Low	Low.
	98	6.0–20	0.04–0.06	6.6–8.4	Low	Low	Low.
Toledo:							
To	0–9	0.6–2.0	0.16–0.22	6.1–7.3	High	High	Low.
	9–44	0.06–0.2	0.12–0.16	6.6–7.8	High	High	Low.
	44–64	0.06–0.2	0.08–0.12	7.4–8.4	High	High	Low.
Tuscola variant:							
TuB, TuC	0–9	2.0–6.0	0.16–0.22	5.6–7.3	Low	Moderate	Moderate.
	9–31	0.6–2.0	0.16–0.20	5.6–7.3	Moderate	Moderate	Moderate.
	31–60	0.6–6.0	0.12–0.20	6.6–8.4	Low	Moderate	Low.
Udorthents:							
Ud.							
Urban land:							
Ur.							
Wallkill:							
Wc	0–7	0.6–2.0	0.15–0.20	5.6–7.3	Low	Moderate	Moderate.
	7–20	0.6–2.0	0.16–0.21	5.6–7.8	Low	Moderate	Moderate.
	20–60	2.0–20.0	0.20–0.30	5.6–7.8	Low	High	Moderate.
Wallkill variant:							
Wk	0–8	0.6–2.0	0.14–0.20	5.6–7.3	Moderate	High	Moderate.
	8–32	0.06–0.6	0.12–0.16	5.6–7.3	Moderate	High	Moderate.
	32–60	2.0–20	0.20–0.30	4.5–7.3		High	Moderate.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 12.—*Soil and*

[Absence of an entry indicates the feature is not a concern. See text for explanation

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Arkport: ApB	B	None		
Belmore: BlB	B	None		
Blount: BnA, BnB, BnB2, BoA, BoB	C	None		
Bono: Bp	B/D	None		
Boyer: BrB, BrC, BsD	B	None		
Carlisle: Ca	A/D	Frequent	Long	Nov-May
Ceresco: Ce	B	Common	Brief	Jan-Jun
Cohoctah: Ch	B/D	Common	Brief	Jan-Jun
Colwood: Cp	B/D	None		
Del Rey: DeA, DeB, DfA, DfB	C	None		
Digby: DgA, DmA	C	None		
Edwards: Ed	B/D	Frequent	Long	Nov-May
Eel: Ee	C	Frequent	Brief	Jan-Jun
Fulton: FsA, FsB, FuA, FuB	D	None		
Genesee: Ge	B	Frequent	Brief	Jan-Jun
Gilford: Gf	B/D	None		
Glynwood: GlB, GlB2, GlC, GlC2, GlD2, GlE2.	C	None		
Haney: HaB	B	None		
[1] HeB:				
Haney part	B	None		
Rawson part	B	None		
[1] HeC:				
Haney part	B	None		
Rawson part	B	None		
Haskins: HkA, HnA	C	None		
Hoytville: Hv	D	None		

water features

of hydrologic groups. The symbol < means less than; > means greater than]

High water table			Bedrock		Potential frost action
Depth	Kind	Months	Depth	Hardness	
Ft			*In*		
>6.0			>60		Low.
>4.0	Apparent		>60		Low.
0.5–1.5	Perched	Jan-May	>60		High.
0–0.5	Perched	Dec-May	>60		Moderate.
>6.0			>60		Low.
0–0.5	Apparent	Nov-Jun	>60		High.
0.5–1.5	Apparent	Jan-May	>60		High.
0–0.5	Apparent	Dec-May	>60		High.
0–0.5	Apparent	Dec-May	>60		High.
0.5–1.5	Perched	Jan-May	>60		High.
0.5–1.5	Perched	Jan-Apr	>60		High.
0–0.5	Apparent	Nov-Jun	>60		High.
1.5–3.0	Apparent	Jan-Apr	>60		High.
0.5–1.5	Perched	Dec-May	>60		Moderate.
>6.0			>60		Moderate.
0–0.05	Apparent	Dec-May	>60		High.
1.5–3.0	Perched	Jan-Apr	>60		High.
1.5–3.0	Perched	Jan-Apr	>60		High.
1.5–3.0	Perched	Jan-Apr	>60		High.
1.5–4.0	Perched	Jan-Apr	>60		Moderate.
1.5–3.0	Perched	Jan-Apr	>60		High.
1.5–4.0	Perched	Jan-Apr	>60		Moderate.
0.5–2.0	Perched	Jan-Apr	>60		High.
0–0.5	Perched	Jan-Apr	>60		Moderate.

TABLE 12.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Kibbie: KIA, KIB	B	None		
Lamson: La	D	None		
Landes: Lb	B	Common	Brief	Jan-Jun
Latty: Lc	D	None		
Lenawee: Lf	B/D	None		
Lucas: LuB2, LuC2, LuD2	D	None		
Martisco: Ma	D	Frequent	Long to very long	Nov-Jun
Mermill: Md	B/D	None		
Millgrove: Mh, Mk	B/D	None		
Nappanee: NnA, NnB, NpA	D	None		
Oshtemo: OrB, OrC, OsB	B	None		
Ottokee: OtB	A	None		
Paulding: Pa	D	None		
Pewamo: Pm	B/D	None		
Rawson: RIB, RIC, RmB, RmC	B	None		
Rimer: RnA	C	None		
Roselms: RsA, RsB	D	None		
St. Clair: SbB2, SbC2, SbD2	D	None		
Seward: SdB	B	None		
Shinrock: SgB, SgC	C	None		
Shoals: Sh	C	Frequent	Brief	Jan-Jun
Sloan: Sn, So	B/D	Frequent	Brief	Jan-Jun
Spinks: SpB, SpC	A	None		

water features—Continued

High water table			Bedrock		Potential frost action
Depth	Kind	Months	Depth	Hardness	
Ft			*In*		
0.5–1.5	Apparent	Dec-May	>60		High.
0–0.5	Apparent	Dec-May	>60		High.
3.0–6.0	Apparent	Mar-May	>60		Moderate.
0–0.5	Perched	Jan-Apr	>60		Moderate.
0–1.0	Perched	Dec-May	>60		High.
1.5–3.0	Perched	Jan-Apr	>60		Moderate.
0–0.5	Apparent	Nov-Jun	>60		High.
0–0.5	Perched	Dec-May	>60		High.
0–0.5	Apparent	Dec-May	>60		High.
0.5–1.5	Perched	Dec-May	>60		Moderate.
>6.0			>60		Low.
1.5–3.0	Apparent	Jan-Apr	>60		Low.
0–0.5	Perched	Jan-Apr	>60		Moderate.
0–0.5	Perched	Dec-May	>60		High.
1.5–4.0	Perched	Jan-Apr	>60		Moderate.
0.5–2.0	Perched	Jan-Apr	>60		High.
0.5–1.5	Perched	Jan-Apr	>60		Moderate.
1.5–3.0	Perched	Mar-May	>60		Moderate.
1.5–3.0	Perched	Jan-Apr	>60		Moderate.
1.5–3.0	Perched	Dec-May	>60		High.
0.5–1.5	Apparent	Jan-Apr	>60		High.
0–0.5	Apparent	Dec-Jun	>60		High.
>6.0			>60		Low.

TABLE 12.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Toledo: To	D	None		
Tuscola variant: TuB, TuC	B	None		
Udorthents: Ud	C	None		
Urban land: Ur.				
Wallkill: Wc	D	Common		
Wallkill variant: Wk	D	Common	Brief	

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior

ment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Test Data

This section discusses the physical and chemical analyses of the soils in Williams County and indicates where these data can be obtained. The engineering test data for the soils are also given.

Physical and chemical analyses

Most of the soils in Williams County were sampled and laboratory data determined by the Agronomy Department, Ohio Agricultural Research and Development Center (OARDC), Columbus, Ohio. The physical and chemical data obtained on most samples include particle-size distribution, reaction, organic-matter content, calcium carbonate equivalent, and extractable cations.

These data were used in the classification and correlation of these soils and in evaluating their behavior under various land uses. Among these data, 11 of the profiles were selected as representative for their respective series and are described in this survey. These series and their laboratory identification number are: Blount (WL-6), Genesee (WL-27), Gilford (WL-23), Lamson (WL-29), Lenawee (WL-17), Nappanee (WL-24), Oshtemo (WL-22), Paulding (WL-28), Pewamo (WL-30), Roselms (WL-13), and Tuscola variant (WL-25).

In addition to the Williams County data, laboratory data are also available from nearby counties in northwestern Ohio with many of the same soils. These data and the Williams County data are on file at the Agronomy Department, OARDC, Columbus, Ohio; the Ohio Department of Natural Resources, Divisions of Lands and Soil, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio. Some of these data have been published through special studies of soils in Williams and nearby counties (*4*, *5* and *13*).

Engineering test data

The results of analyses of engineering properties of several representative soils of the survey are given in table 13.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are representative of the series discussed in "Descriptions of the Soils." The soil samples were analyzed mainly by the Soil Physical Studies Laboratory, Ohio State University. Part of the moisture density determinations were made by the Ohio Department of Transportation Soil Testing Laboratory.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods codes assigned by the American Association of State Highway and Transportation Officials (AASHTO). The code for Unified Classification was assigned by the American Society for Testing and Materials.

The methods and codes are—AASHTO classification

water features—Continued

High water table			Bedrock		Potential frost action
Depth	Kind	Months	Depth	Hardness	
Ft			*In*		
0–0.5	Perched	Dec-May	>60		Moderate.
1.5–3.0	Perched	Dec-May	>60		High.
>6.0			>60		Moderate.
0–0.5	Apparent	Nov-Jun	>60		High.
0–0.5	Apparent	Nov-Jun	>60		High.

of the whole map unit.

(M–145–66), Unified classification (D–2487–66T), Mechanical analysis (T88–57), Liquid limit (T89–60), Plasticity index (T98–56), and Moisture-Density, method A (T99–57).

Descriptions of the Soils

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

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

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

Preceding the name of each map unit is a symbol. This symbol identifies the map unit on the detailed soil map. Listed at the end of each description of a map unit is the capability unit and woodland subclass in which the map unit has been placed. The description of each capability unit can be found in the section "Management by capability units."

The acreage and proportionate extent of each map unit are shown in table 14. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*15*).

Arkport Series

The Arkport series consists of well drained, gently sloping soils. These soils formed in sandy, water-deposited material.

In a representative profile the surface layer is dark grayish brown loamy fine sand about 10 inches thick. The subsurface layer, from a depth of 10 to 24 inches, is dark brown and pale brown loamy fine sand. The subsoil, from 24 to 79 inches, is mostly pale brown loamy very fine sand with dark brown very fine sandy loam bands. The substratum to a depth of 89 inches is dark brown, stratified very fine sand and silt with grayish brown mottles.

Arkport soils have a deep root zone but have a low available water capacity and are droughty during prolonged dry periods. Permeability is moderately rapid.

Arkport soils are moderately well suited to farming. They are well suited to woodland and to woodland wildlife.

Most areas are used for cultivated crops. A few remain wooded.

Representative profile of Arkport loamy fine sand, 2 to 6 percent slopes, in a cultivated field NE¼NE¼ NE¼NE¼ sec. 9, Brady Township, T. 7 N., R.

TABLE 13.—*Engineering*

Soil name and location	Parent material	Report number	Depth	Moisture density	
				Maximum	Optimum
			In	*lb/cu ft*	*Pct*
Blount loam (WL-7): NE¼, SE¼, NE¼, sec. 35, St. Joseph Township, T. 6 N., R. 1 E, about 3 mi. SE of Edgerton, west of County Road 6. (Modal.)	Glacial till	19073	13–23		
		19074	30–36		
		19075	50–57		
Blount loam (WL-10): NW¼, SW¼, SW¼, SW¼, sec. 18, Madison Township, T. 9 S, R. 2 W.; 0.15 mi. north of County Road R and 120 feet east of County Road 12. (Modal.)	Glacial till	19082	11–14		
		19083	21–26		
		19084	42–48		
Boyer loamy sand (WL-12): SE¼, SE¼, SE¼, sec. 32, St. Joseph Township, T. 6 N., R. 1 E.; 55 feet west of cemetery fence and 25 feet south of County Road A-3. (Modal.)	Water deposited loamy and sandy materials overlying gravel and sand.	19993	0–12		
		19994	12–23		
		19995	23–30		
		19996	30–40		
		19997	40–60		
Fulton silty clay loam (WL-14): NE¼, SE¼, SW¼, NE¼, sec. 31, Springfield Township, T. 6 N, R. 4 E.; 120 feet west and 375 north of field boundaries. (Modal.)	Lacustrine clays and silts	20006	0–8		
		20007	8–10		
		20008	10–16		
		20009	16–23		
		20010	23–32		
		20011	32–42		
		20012	42–60		
Gilford (WL-23): SW¼, SE¼, NE¼, NE¼, sec. 10, Pulaski Township, T. 6 N., R. 3 E.; 240 feet west of County Road 17. (Modal.)	Sandy outwash deposits	20575	0–11		
		20576	11–16		
		20577	16–26		
		20578	26–39		
		20579	39–49		
Glynwood loam (WL-4): SE¼, NW¼, NE¼, NW¼, sec. 17, Northwest Township, T. 9 S, R. 4 W.; 0.2 mi. west of County Road 150 on County Road S. (contains less clay than modal in horizons below a depth of 22 inches.)	Glacial till	19050	0–7		
		19051	7–9		
		19052	9–13		
		19053	13–17		
		19054	17–22		
		19055	22–28		
		19056	28–36		
		19057	49–57		
Glynwood loam (WL-5): NW¼, SW¼, NW¼, NW¼, sec. 5, Florence Township, T. 7 N., R. 1 E.; 0.15 mi. south of County Road M and 50 feet east of County Road 2. (contains less clay than modal in horizons below a depth of 15 inches.)	Glacial till	19058	0–7		
		19059	7–9		
		19060	9–15		
		19061	15–25		
		19062	25–32		
		19063	32–40		
		19064	53–61		
Glynwood loam (WL-8): SW¼, SW¼, SE¼, sec. 33, Center Township, T. 6 N., R. 2 E.; 10 feet east and 60 feet north of telephone pole along south side of County Road A. (contains slightly more clay than modal in horizons below a depth of 27 inches.)	Glacial till	19076	18–21		
		19077	27–35		
		19078	54–61		
Latty silty clay (WL-20): NE¼, SE¼, SE¼, NE¼, sec. 31, Springfield Township, T. 6 N, R. 4 E; 35 feet south of field boundary and 90 feet west of small barn. (Modal.)	Lacustrine clay	20013	0–9		
		20014	9–16		
		20015	16–22		
		20016	22–32		
		20017	32–40		
		20018	40–53		
		20019	53–59		
		20020	69–85		

test data

Percentage passing sieve			Percentage smaller than				Liquid limit	Plasticity index	Classification	
No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	Unified
							Pct			
100	96	85			57		45	15	A-7-5(11)	ML[1]
100	95	86			54		35	12	A-6(9)	CL
100	95	86			55		35	13	A-6(9)	CL
100	96	84			58		46	19	A-7-6(13)	CL, ML[1]
100	95	84			53					
100	95	84			52		34	12	A-6(9)	CL
100	75	21			11					
100	72	20			9					
100	60	28			21			7	A-4(0)	SC, SM-SC
100	49	9			3		NP[2]	NP		
100	51	7			1		NP	NP		
100	97	93			52					
100	99	98			61					
100	99	98			61		47	19	A-7-6(13)	ML[1]
100	99	98			62		48	21	A-7-6(14)	CL
100	99	99			68					
100	99	99			67					
100	99	99			69		47	23	A-7-6(14)	CL
100	79	40			21					
100	67	27			15		NP	NP		
100	66	22			13		NP	NP		
100	52	20			6		NP	NP		
100	86	56			26					
100	94	77			48					
100	94	79			52		41	15	A-7-6(10)	ML[1]
100	94	79			52					
100	93	75			47		42	17	A-7-6(11)	CL
100	90	68			39		35	15	A-6(9)	CL
100	90	67			34		30	9	A-4(6)	CL
100	87	67			33		28	11	A-6(7)	CL
100	92	64			27					
100	93	72			37					
100	94	77			43		38	14	A-6(10)	CL
100	95	81			50		43	19	A-7-6(12)	CL
100	94	78			39					
100	93	78			35					
100	89	70			31		25	7	A-4(7)	CL
100	93	77			56		46	23	A-7-6(14)	CL
100	95	85			55					
100	95	85			55		32	11	A-6(8)	CL
100	99	98			86					
100	99	95			71		62	29	A-7-5(20)	MH[1]
100	98	95			72		64	35	A-7-6(20)	CH
100	99	95			70					
100	99	95			69		62	35	A-7-6(20)	CH
100	98	93			66		57	30	A-7-6(19)	CH
100	99	98			81					
							62	35	A-7-6(20)	CH

TABLE 13.—*Engineering*

Soil name and location	Parent material	Report number	Depth	Moisture density	
				Maximum	Optimum
			In	*lb/cu ft*	*Pct*
Latty silty clay (WL-20): NW¼, SE¼, NW¼, NE¼, sec. 14, Springfield Township, T. 6 N, R. 4 E.; 0.15 mi. east of County Road 2350 and 170 feet SE of barn. (Modal.)	Lacustrine clay	20553	0–10	97	23
		20554	10–16		
		20555	16–23	100	22
		20556	23–34	109	24
		20557	34–44		
		20558	44–62		
		20559	62–72	103	20
Lenawee (WL-17): NW¼, NW¼, NW¼, SE¼, sec. 10, Springfield Township, T. 6 N, R. 4 E.; 45 feet south of County Road E-50. (Modal.)	Lacustrine silts and clays	20532	0–5		
		20533	5–10	98	20
		20534	10–18		
		20535	18–31	107	20
		20536	31–36	105	18
		20537	36–46		
		20538	46–56		
		20539	56–62	108	18
Napanee (WL-24): NE¼, NW¼, SE¼, NE¼, sec. 4, Pulaski Township, T. 6 N, R. 3 E.; 250 feet north of County Road F-75, 1,650 feet east of County Road 15. (Modal.)	Glacial till, reworked on top by glacial lake action.	25835	4–8	107	18
		25836	8–13	102	20
		25837	38–60	115	15
Roselms (WL-13): SE¼, SE¼, SE¼, SW¼, sec. 35, Springfield Township, T. 6 N., R. 4 E.; 0.6 mile west of State Route 66, 75 feet north of fence. (Modal.)	Lacustrine clays	19998	0–8		
		19999	8–15		
		20000	15–19		
		20001	19–26		
		20002	26–32		
		20003	32–42		
		20004	42–47		
		20005	47–60		
Tuscola variant (WL-25): SW¼, NW¼, SE¼, NW¼, sec. 16, Brady Township, T. 7 N., R. 4 E.; 500 feet northwest of house. (Modal.)	Stratified silts and sands	26401	13–22	112	16
		26402	54–60		

[1] Sample taken from the top part of the B horizon and is slightly outside the range of engineering properties given to repre-
[2] NP-Nonplastic.

4 E., 375 feet south of U.S. Route 20A and 75 feet west of County Road 22:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loamy fine sand; very weak medium subangular blocky structure parting to weak fine granular; very friable; many fine roots; few pebbles; strongly acid; abrupt smooth boundary.

A21—10 to 21 inches; dark brown (7.5YR 4/4) loamy fine sand; very weak coarse subangular blocky structure; very friable; common fine roots; 1 percent fine pebbles; medium acid; abrupt smooth boundary.

A22—21 to 24 inches; pale brown (10YR 6/3) loamy fine sand; very weak coarse subangular blocky structure; very friable; common fine roots; few reddish brown (5YR 4/4) bands 2 millimeters thick; medium acid; abrupt wavy boundary.

A&B—24 to 76 inches; pale brown (10YR 6/3) loamy very fine sand; very weak subangular blocky structure; very friable; irregular dark brown (7.5YR 4/4) very fine sandy loam lamellae with weak fine angular blocky structure; lamellae are 1 to 6 inches thick, occurring at depths of 24, 32, 38, 42, 45 inches and intermittently below 53 inches; few fine roots; slightly acid; abrupt wavy boundary.

B3—76 to 79 inches; dark brown (10YR 4/3) very fine sandy loam; common medium distinct grayish brown (2.5Y 5/2) mottles; weak thin platy structure; friable; slightly acid; clear wavy boundary.

IIC—79 to 89 inches; dark brown (10YR 4/3) stratified very fine sand and silt; common medium distinct grayish brown (2.5Y 5/2) mottles; weak thin platy structure; friable; strong brown (7.5YR 5/6) iron nodules; calcareous; moderately alkaline.

test data—Continued

Percentage passing sieve			Percentage smaller than				Liquid limit	Plasticity index	Classification	
No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	Unified
							Pct			
100	99	99			65					
100	99	99			73		65	39	A-7-6(20)	CH
100	99	98			71					
100	99	99			68		63	37	A-7-6(20)	CH
100	99	98			68					
100	99	99			67		58	31	A-7-6(20)	CH
100	99	99			75		59	30	A-7-6(20)	CH
100	99	97			52					
100	99	96			54					
100	99	97			57		50	11	A-7-5(10)	ML, MH[1]
100	99	97			58					
100	99	98			64		50	25	A-7-6(16)	CL, CH
100	99	98			53					
100	99	99			50		40	11	A-6(8)	ML
100	100	99			46		36	16	A-6(10)	CL
99	97	80			45		30	12	A-6(9)	CL
99	98	88			65		41	21	A-7-6(13)	CL
98	95	85			56		33	16	A-6(10)	CL
100	97	93			66					
100	99	98			78					
100	99	98			78		60	30	A-7-5(20)	CH
100	100	99			80					
100	100	99			79		53	27	A-7-6(17)	CH
100	100	100			83					
100	100	100			81					
100	100	100			82		51	26	A-7-6(16)	CH
100	99	86			25		27	10	A-4(8)	CL
100	100	84			7			NP		

sent the main part of this horizon.

The depth to carbonates ranges from 40 to 110 inches. The thickness of the solum ranges from 45 to 90 inches. Depth to first lamellae ranges from 20 to 30 inches.

The Ap horizon is generally 4 to 11 inches thick. It is dark grayish brown, grayish brown, or brown in 10YR hue, value of 4 or 5, and chroma of 2 or 3. Reaction ranges from strongly acid to neutral.

The A2 horizon and the A2 part of the A&B horizon are 7.5YR or 10YR hue, value of 3 through 6, and chroma of 3 or 4. The texture ranges from fine sand to loamy very fine sand. Reaction ranges from strongly acid to slightly acid.

The Bt part of the A&B horizon is lamellae that range from one-fourth inch to 6 inches thick and have a total thickness of 10 to 18 inches. It ranges from 5YR through 10YR hue, value of 3 through 5, and chroma of 3 or 4. The texture ranges from loamy fine sand to very fine sandy loam. Reaction ranges from strongly acid to slightly acid.

The C horizon is 10YR hue, value of 4 through 6, and chroma of 3 through 5. Stratified textures range from very fine sand to silt. The reaction ranges from neutral to moderately alkaline. This horizon is calcareous in places.

Arkport soils are the well drained members of a drainage sequence that includes the very poorly drained Lamson soils. Arkport soils are similar to Spinks soils but have slightly more clay in the lamellae in the subsoil. They resemble Ottokee soils but do not have gray mottles in the subsoil and have slightly more clay in the lamellae.

ApB—Arkport loamy fine sand, 2 to 6 percent slopes. This soil occurs as long strips on deltas and outwash plains. Slopes are gentle and short.

Included with this soil in mapping are spots of the poorly drained Lamson and the moderately well drained Tuscola variant. These spots are generally less than 2 acres in size and occur on the more level areas and lower parts of slopes. Small areas of Ottokee soils are also included.

A moderate erosion hazard is the major limitation

TABLE 14.—*Acreage and proportionate extent of the soils*

Map symbol	Soil name	Acres	Percent
ApB	Arkport loamy fine sand, 2 to 6 percent slopes	274	0.1
BlB	Belmore sandy loam, 1 to 6 percent slopes	461	0.2
BnA	Blount loam, 0 to 2 percent slopes	35,270	13.1
BnB	Blount loam, 2 to 6 percent slopes	46,100	17.1
BnB2	Blount loam, 2 to 6 percent slopes, moderately eroded	695	0.3
BoA	Blount loam, loamy substratum, 0 to 2 percent slopes	698	0.3
BoB	Blount loam, loamy substratum, 2 to 6 percent slopes	4,621	1.7
Bp	Bono silty clay loam	2,082	0.8
BrB	Boyer loamy sand, 1 to 6 percent slopes	1,010	0.4
BrC	Boyer loamy sand, 6 to 12 percent slopes	155	0.1
BsD	Boyer gravelly loamy sand, 12 to 18 percent slopes	85	(1)
Ca	Carlisle muck	5,479	2.0
Ce	Ceresco sandy loam	358	0.1
Ch	Cohoctah loam	226	0.1
Cp	Colwood silt loam	444	0.2
DeA	Del Rey loam, 0 to 2 percent slopes	2,401	0.9
DeB	Del Rey loam, 2 to 6 percent slopes	865	0.3
DfA	Del Rey silty clay loam, 0 to 2 percent slopes	3,581	1.3
DfB	Del Rey silty clay loam, 2 to 6 percent slopes	982	0.4
DgA	Digby sandy loam, 0 to 3 percent slopes	2,392	0.9
DmA	Digby loam, 0 to 3 percent slopes	2,482	0.9
Ed	Edwards muck	108	(1)
Ee	Eel loam	1,826	0.7
FsA	Fulton loam, 0 to 2 percent slopes	1,466	0.5
FsB	Fulton loam, 2 to 6 percent slopes	295	0.1
FuA	Fulton silty clay loam, 0 to 2 percent slopes	5,661	2.1
FuB	Fulton silty clay loam, 2 to 6 percent slopes	1,158	0.4
Ge	Genesee loam	1,396	0.5
Gf	Gilford fine sandy loam	1,576	0.6
GlB	Glynwood loam, 2 to 6 percent slopes	11,651	4.3
GlB2	Glynwood loam, 2 to 6 percent slopes, moderately eroded	6,269	2.3
GlC	Glynwood loam, 6 to 12 percent slopes	1,333	0.5
GlC2	Glynwood loam, 6 to 12 percent slopes, moderately eroded	8,011	3.0
GlD2	Glynwood loam, 12 to 18 percent slopes, moderately eroded	2,900	1.1
GlE2	Glynwood loam, 18 to 40 percent slopes, moderately eroded	949	0.4
HaB	Haney loam, 1 to 6 percent slopes	2,871	1.1
HeB	Haney-Rawson sandy loams, 1 to 6 percent slopes	748	0.3
HeC	Haney-Rawson sandy loams, 6 to 12 percent slopes	236	0.1
HkA	Haskins sandy loam, 0 to 3 percent slopes	5,790	2.2
HnA	Haskins loam, 0 to 3 percent slopes	11,100	4.1
Hv	Hoytville clay	3,322	1.2
KlA	Kibbie very fine sandy loam, 0 to 2 percent slopes	1,860	0.7
KlB	Kibbie very fine sandy loam, 2 to 6 percent slopes	327	0.1
La	Lamson very fine sandy loam	841	0.3
Lb	Landes sandy loam	738	0.3
Lc	Latty silty clay	7,731	2.9
Lf	Lenawee silty clay loam	4,569	1.7
LuB2	Lucas silty clay loam, 2 to 6 percent slopes, moderately eroded	274	0.1
LuC2	Lucas silty clay loam, 6 to 12 percent slopes, moderately eroded	500	0.2
LuD2	Lucas silty clay loam, 12 to 25 percent slopes, moderately eroded	790	0.3
Ma	Martisco muck	116	(1)
Md	Mermill loam	8,122	3.0
Mh	Millgrove loam	6,794	2.5
Mk	Millgrove clay loam	426	0.2
NnA	Nappanee loam, 0 to 2 percent slopes	1,673	0.6
NnB	Nappanee loam, 2 to 6 percent slopes	746	0.3
NpA	Nappanee silty clay loam, 0 to 2 percent slopes	1,906	0.7
OrB	Oshtemo loamy sand, 2 to 6 percent slopes	1,418	0.5
OrC	Oshtemo loamy sand, 6 to 12 percent slopes	268	0.1
OsB	Oshtemo sandy loam, 2 to 6 percent slopes	1,574	0.6
OtB	Ottokee fine sand, 0 to 6 percent slopes	1,138	0.4
Pa	Paulding clay	718	0.3
Pm	Pewamo silty clay loam	21,018	7.8
RlB	Rawson sandy loam, 2 to 6 percent slopes	2,330	0.9
RlC	Rawson sandy loam, 6 to 12 percent slopes	288	0.1
RmB	Rawson loam, 2 to 6 percent slopes	1,151	0.4
RmC	Rawson loam, 6 to 12 percent slopes	336	0.1
RnA	Rimer loamy fine sand, 0 to 3 percent slopes	583	0.2
RsA	Roselms silty clay, 0 to 2 percent slopes	1,185	0.4
RsB	Roselms silty clay, 2 to 6 percent slopes	318	0.1
SbB2	St. Clair silty clay loam, 2 to 6 percent slopes, moderately eroded	232	0.1
SbC2	St. Clair silty clay loam, 6 to 12 percent slopes, moderately eroded	199	0.1
SbD2	St. Clair silty clay loam, 12 to 25 percent slopes, moderately eroded	157	0.1
SdB	Seward loamy fine sand, 2 to 6 percent slopes	1,281	0.5
SgB	Shinrock silt loam, 2 to 6 percent slopes	357	0.1
SgC	Shinrock silt loam, 6 to 12 percent slopes	182	0.1
Sh	Shoals loam	2,753	1.0
Sn	Sloan loam	5,097	1.9
So	Sloan silty clay loam	1,852	0.7
SpB	Spinks fine sand, 2 to 6 percent slopes	592	0.2
SpC	Spinks fine sand, 6 to 18 percent slopes	324	0.1
To	Toledo silty clay	1,915	0.7

TABLE 14.—*Acreage and proportionate extent of the soils*—Continued

Map symbol	Soil name	Acres	Percent	Map symbol	Soil name	Acres	Percent
TuB	Tuscola variant fine sandy loam, 1 to 6 percent slopes	608	0.2	Wk	Wallkill variant silty clay loam	782	0.3
TuC	Tuscola variant fine sandy loam, 6 to 12 percent slopes	279	0.1		Gravel pits	356	0.1
Ud	Udorthents	1,402	0.5		Made land	59	(1)
Ur	Urban land	224	0.1		Sand pits	64	(1)
Wc	Wallkill silt loam	561	0.2		Water	971	0.4
					Total	269,312	100.0

[1] Less than 0.1 percent.

for farming. Droughtiness is also a problem. Soil blowing, which removes the surface soil and causes sand abrasion of plant seedlings, is a serious hazard. Moderately rapid permeability and sandy texture are limitations for some nonfarm uses.

Most areas are used for crops. Some are wooded. This soil is moderately well suited to farming if erosion and soil blowing are controlled. Capability unit IIe-3; woodland suitability 3s.

Belmore Series

The Belmore series consists of well drained, gently sloping soils on beach ridges. These soils formed in water-deposited loamy materials and the underlying gravelly sandy and sandy material. They are commonly on shorelines of former glacial lakes, particularly on various stages of Lake Maumee. They occupy crests and upper parts of slopes on beach ridges.

In a representative profile the surface layer is dark grayish brown sandy loam 9 inches thick. The upper part of the subsoil, from 9 to 15 inches, is dark brown sandy loam. The middle part, from 15 to 30 inches, is dark brown sandy clay loam. The lower part, from 30 to 45 inches, is dark reddish brown and dark brown gravelly sandy clay loam. The substratum to a depth of 72 inches is brown and pale brown stratified sandy and gravelly material with lenses of silty material.

Belmore soils have a deep root zone and a moderate available water capacity, but they are droughty during prolonged dry periods. Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum.

Belmore soils are moderately well suited to farming. They are well suited to openland wildlife and woodland. Limitations for most nonfarm uses are slight to moderate.

Most areas are used for cultivated crops or pasture. A few are wooded.

Representative profile of Belmore sandy loam, 1 to 6 percent slopes, in a cultivated field NE¼NE¼NW¼ sec. 34, Jefferson Township; T. 7 N., R. 3 E., 0.1 mile west of U.S. Route 127, and 18 feet south of County Road H:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy loam; very weak medium platy structure parting to moderate fine granular; very friable; many fine roots; 1 percent coarse gravel and 2 percent fine gravel; neutral; abrupt smooth boundary

B1—9 to 15 inches; dark brown (10YR 4/3) heavy sandy loam; weak medium subangular blocky structure; very friable; common fine roots; very dark grayish brown (10YR 3/2) fillings in channels; 2 to 3 percent fine gravel; slightly acid; clear smooth boundary.

B21t—15 to 21 inches; dark brown (7.5YR 4/4) light sandy clay loam; weak medium angular blocky structure; friable; common fine roots; thin very patchy clay films on faces of peds; 3 to 4 percent fine gravel; neutral; clear wavy boundary.

B22t—21 to 30 inches; dark brown (7.5YR 4/4) sandy clay loam; weak coarse angular blocky structure parting to moderate medium subangular blocky; friable; common fine roots; thin very patchy clay films on faces of peds; 3 to 4 percent fine gravel; mildly alkaline; clear wavy boundary.

IIB23t—30 to 38 inches; dark reddish brown (5YR 3/3) gravelly sandy clay loam; weak coarse subangular blocky structure parting to moderate medium subangular blocky; friable; common fine roots; thin patchy clay films on vertical and horizontal faces of peds and on gravel; 16 to 18 percent fine gravel; mildly alkaline; abrupt wavy boundary.

IIB3t—38 to 45 inches; dark brown (7.5YR 3/2) gravelly sandy clay loam; weak coarse subangular blocky structure parting to weak medium subangular blocky; friable; common fine roots; thin patchy clay films on faces of peds and on gravel and sand grains; 20 to 30 percent fine gravel; mildly alkaline; abrupt irregular boundary.

IIIC1—45 to 52 inches; brown (10YR 5/3) gravelly loamy sand; single grained; loose; few fine roots; thin lenses of silty material; 20 to 30 percent fine gravel; calcareous; moderately alkaline; abrupt wavy boundary.

IVC2—52 to 72 inches; pale brown (10YR 6/3) stratified sand, gravelly sand, and silt;

single grained; loose; 20 to 30 percent fine gravel; calcareous; moderately alkaline.

The depth to carbonates ranges from 37 to 55 inches. The thickness of the solum ranges from 39 to 53 inches. Gravel content in the solum ranges from 2 to 15 percent in the upper part and from 10 to 35 percent in the lower part.

The A horizon is 10YR hue, value of 4 or 5, chroma of 2 or 3. Reaction ranges from slightly acid to neutral. Some pedons have a thin A2 horizon.

The B horizon is 10YR to 7.5YR hue with individual subhorizons of 5YR. Value is 3 through 5, and chroma is 2 through 4. The texture ranges from heavy sandy loam to sandy clay loam and gravelly analogs of these textures. Reaction ranges from slightly acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part.

The C horizon is 2 feet to several feet thick. It is 10YR hue, value of 4 through 6, and chroma of 3 through 6. The texture ranges from loamy sand to sandy loam with strata of silt loam, sand, and gravelly analogs of these textures.

Belmore soils are the well drained members of a drainage sequence that includes the very poorly drained Millgrove soils, the somewhat poorly drained Digby soils, and the moderately well drained Haney soils. Belmore soils resemble Oshtemo soils but have more clay throughout the subsoil. They are similar to Boyer soils but have a thicker solum.

BlB—Belmore sandy loam, 1 to 6 percent slopes. This gently sloping soil occupies crests and upper slopes on beach ridges of former glacial lakes. Most slopes are short. The soil is very friable, has good tilth, and is easy to keep in good tilth.

Included with this soil in mapping are small areas of the well drained Oshtemo soils and the moderately well drained Haney and Rawson soils. Also included are small areas of the somewhat poorly drained Digby and Haskins soils and the very poorly drained Millgrove and Mermill soils on lower parts of slopes or in depressions and swales. A few areas have a loam surface layer.

Water erosion and soil blowing are the major limitations for farming. Droughtiness during prolonged dry spells is also a limiting factor. The moderately rapid permeability is a limitation for some nonfarm uses of this soil.

Most areas are used for crops, but some are wooded. This soil is well suited to farming if erosion and soil blowing are controlled. It has slight limitations for most recreational and urban uses. Capability unit IIe-1; woodland suitability 2o.

Blount Series

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

In a representative profile the surface layer is dark grayish brown loam about 8 inches thick. The subsoil, from 8 to 16 inches, is mottled dark brown clay, and from 16 to 31 inches, is mottled dark grayish brown and dark brown clay loam. The substratum to a depth of 60 inches is brown clay loam glacial till mottled with dark gray.

Blount soils have a moderately deep root zone and a moderate available water capacity. Permeability is slow to moderately slow in the subsoil and substratum. These soils are saturated for significant periods in winter and spring and dry slowly unless adequately drained.

Blount soils are well suited to farming if excess water is removed. They are well suited to openland wildlife. Limitations for most nonfarm uses are moderate to severe.

Most areas have been cleared and are used for cultivated crops and pasture. A few are wooded.

Representative profile of Blount loam, 2 to 6 percent slopes, in a cultivated field SE¼SE¼NE¼SE¼ sec. 25, Madison Township; T. 9 S., R. 2 W., 0.3 mile north of County Road P on County Road 18; 70 feet west of County Road 18 and 67 feet north of field boundary:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure; friable; many fine roots; few pebbles; neutral; abrupt wavy boundary

B1t—8 to 11 inches; yellowish brown (10YR 5/4) clay; few fine faint dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; grayish brown (10YR 5/2) silt coatings up to 2 millimeters thick; 2 percent glacial pebbles; thin very patchy dark yellowish brown (10YR 4/4) clay films; strongly acid; abrupt wavy boundary.

B21t—11 to 16 inches; dark brown (10YR 4/3) clay; many medium faint dark grayish brown (10YR 4/2) and few medium distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine angular blocky; firm; common fine roots; dark grayish brown (10YR 4/2) ped surfaces; 2 percent glacial pebbles; thin patchy dark grayish brown (10YR 4/2) clay films; few very dark gray (10YR 3/1) stains; medium acid; clear wavy boundary.

B22t—16 to 24 inches; dark grayish brown (10YR 4/2) clay loam; common fine distinct dark gray (10YR 4/1) and dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; very firm; few fine roots; 2 percent glacial pebbles; thin continuous dark grayish brown (10YR 4/2) clay films; mildly alkaline; clear smooth boundary.

B3t—24 to 31 inches; dark brown (10YR 4/3) clay loam; many fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; few fine roots; 2 percent glacial pebbles; thin dark grayish brown (10YR

4/2) clay films on vertical faces of peds; calcareous; moderately alkaline; clear wavy boundary.

C—31 to 60 inches; brown (10YR 4/3) clay loam; many medium distinct dark gray (10YR 4/1) mottles; weak medium platy structure; very firm; 3 to 4 percent glacial pebbles; calcareous; moderately alkaline.

The depth to carbonates ranges from 16 to 27 inches. The thickness of the solum ranges from 21 to 37 inches. The glacial pebble content ranges from 2 to 5 percent throughout the profile.

The Ap horizon is 10YR hue, value of 4, and chroma of 1 or 2. The A2 horizon, where present, is 2 to 5 inches thick and is 10YR hue, value of 5 or 6, and chroma of 2 through 4.

The B horizon is 10YR hue, value of 4 or 5, and chroma of 2 to 4. The texture ranges from clay loam to clay. Reaction ranges from strongly acid in the upper part to moderately alkaline in the lower part. In places this horizon is calcareous.

The C horizon is loam or clay loam calcareous glacial till. It is 10YR hue, value of 4 or 5, and chroma of 3 or 4.

Blount soils are the somewhat poorly drained members of a drainage sequence that includes the moderately well drained Glynwood and very poorly drained Pewamo soils. Blount soils are similar to Nappanee and Del Ray soils, but they have a less clayey subsoil than Nappanee soils and, unlike the Del Ray soils, lack stratification. They also contain more pebbles.

BnA—Blount loam, 0 to 2 percent slopes. This nearly level soil occurs on glacial till uplands. Surface runoff is slow, and ponding is common.

Included with this soil in mapping are narrow strips of the very poorly drained Pewamo soils. Also included are some areas of soils with a sandy or gravelly surface layer. A few areas southwest of Edon, where the upper 1 or 2 feet of soil formed in stratified moderately fine textured material, are also included.

Seasonal wetness is the major limitation for farming. Soil blowing and water erosion are minor hazards especially on fall plowed ground. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

This soil is well suited to farming if the excess water is removed. Most areas are used for crops, but some remain wooded. Blount soils have moderate to severe limitations for recreational and urban developments. Capability unit IIw–5; woodland suitability 3w.

BnB—Blount loam, 2 to 6 percent slopes. This gently sloping soil occurs on uplands. Most areas are moderate to large and occur as long, low rises and knolls. Some areas are along drainageways. This soil has the profile described as representative of the series. Surface runoff is moderate, and water seldom ponds.

Included with this soil in mapping are narrow strips of the very poorly drained Pewamo soil in natural drainageways and low spots. Spots of the moderately well drained Glynwood soils are included on the steeper areas. Also included are some areas of soils with a sandy or gravelly surface layer and a few areas of soils southwest of Edon where the upper soil layers formed in stratified moderately fine textured material.

The hazard of erosion is the major limitation for farming. Seasonal wetness is also a severe limitation. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas are used for crops, but some are wooded. This soil is well suited to farming if excess water is removed and the soil is protected from erosion. It has moderate to severe limitations for recreational and urban developments. Capability unit IIe–4; woodland suitability 3w.

BnB2—Blount loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is in the uplands. In most areas slopes are 4 to 6 percent. This soil occurs as long strips on breaks along drainageways and on long low rises. It has a profile like the one described as representative of the series, but erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and material from the more clayey, upper part of the subsoil. This soil has a slightly lower available water capacity and has poorer tilth than the less eroded Blount soils.

Included with this soil in mapping are narrow strips of the very poorly drained Pewamo soil in natural drainageways and low spots. Areas of the moderately well drained, steeper Glynwood soils and some areas of soils with a sandy or gravelly surface layer are also included.

Soil erosion is the major limitation for farming. Seasonal wetness is also a limitation. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas are used for crops and pasture. This soil is well suited to farming if it is protected from erosion and excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIIe–3; woodland suitability 3w.

BoA—Blount loam, loamy substratum, 0 to 2 percent slopes. This nearly level soil is in uplands on the Wabash Moraine in the northwestern part of the county. It occurs as low knolls and long, low rises and on tablelike flats on the crests of the moraine. Its profile differs from the one described as representative of the series in having loam texture in the substratum and a thicker surface layer.

Included with this soil in mapping are small areas of the very poorly drained Pewamo soils along drainageways and in low spots. Areas of the sandier Rimer and Haskins soils are also included in some areas.

Seasonal wetness is the major limitation for farming. Seasonal wetness and moderately slow to slow permeability are limitations for many nonfarm uses.

Most areas are used for crops or pasture. Some areas are wooded. This soil is well suited to farming if excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw–5; woodland suitability 3w.

BoB—Blount loam, loamy substratum, 2 to 6 percent slopes. This gently sloping soil is on low rises, on knolls, and on slope breaks adjacent to small drainageways. Slopes are generally short to moderate. The profile differs from the one described as representative of the series in having loam texture in the substratum. Surface runoff is moderate.

Included with this soil in mapping, in more sloping

areas, are areas of Glynwood soil and areas of moderately eroded soils. Also included are areas of the more sandy Rimer and Haskins soils and areas of soils over gravelly clay loam or gravelly sandy loam instead of loam.

The hazard of erosion is the major limitation for farming. Seasonal wetness is also a limitation. The seasonal high water table and moderately slow to slow permeability are limitations for many nonfarm uses.

Most areas are used for crops. Some are wooded. This soil is well suited to farming if excess water is removed and the soil is protected from erosion. It has moderate to severe limitations for recreational and urban developments. Capability unit IIe-4; woodland suitability 3w.

Bono Series

The Bono series consists of very poorly drained soils in depressional areas on moraines and till plains. These soils formed in fine textured lacustrine sediments.

In a representative profile the surface layer is very dark gray silty clay loam 12 inches thick. The subsoil, from 12 to 36 inches, is mottled, gray silty clay. The substratum to a depth of 68 inches is mottled, gray and dark grayish brown stratified loam and clay loam with thin lenses of loamy fine sand and gravelly sandy loam.

Bono soils have a deep root zone when the water table is low and a moderate available water capacity. Permeability is slow to very slow. The soils are saturated for long periods in winter and spring and dry slowly in spring unless drained. Ponding is common.

Bono soils are well suited to farming if the excess water is removed. They are also well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas are used for cultivated crops or pasture. A few are wooded.

Representative profile of Bono silty clay loam in a cultivated field SW¼SW¼SW¼SE¼ sec. 16, Madison Township; T. 9 S., R. 2 W., 88 feet north of Future Farmers of American Welcome sign on County Road R:

Ap—0 to 12 inches; very dark gray (10YR 3/1) heavy silty clay loam; weak fine subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

B21g—12 to 21 inches; gray (5Y 5/1) light silty clay; common fine distinct dark brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; common fine roots; gray (N 5/0) prism faces with dark gray (N 4/0) organic stains; few snail shells; moderately alkaline; gradual smooth boundary.

B22g—21 to 28 inches; gray (5Y 5/1) silty clay; few fine distinct dark brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; common fine roots; dark gray (N 4/0) prism faces and filling in old root channels; moderately alkaline; gradual smooth boundary.

B23g—28 to 36 inches; gray (5Y 5/1) silty clay; many medium distinct olive brown (2.5Y 4/4) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; firm; few fine roots; gray (N 5/0) prism faces; moderately alkaline; abrupt smooth boundary.

IIC1g—36 to 47 inches; gray (5Y 5/1) loam with thin strata of loamy fine sand and gravelly sandy loam; few fine distinct dark brown (10YR 4/3) mottles; moderate thick platy structure; friable; 2 percent coarse gravel; moderately alkaline; abrupt smooth boundary.

IIIC2g—47 to 68 inches; dark grayish brown (2.5Y 4/2) heavy clay loam; many coarse distinct gray (5Y 5/1) and common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; 5 percent coarse gravel; moderately alkaline.

The thickness of the solum ranges from 25 to 40 inches.

The A horizon is generally 11 to 14 inches thick and is 10YR or 2.5Y hue, value of 2 or 3, and chroma of 1 or 2.

The B horizon is 10YR through 5Y hue or neutral, value of 4 or 5, and chroma of 0 through 2. The texture is silty clay with less than 12 percent sand. Reaction ranges from mildly alkaline to moderately alkaline. In places this horizon is calcareous in the lower part.

The C horizon is 1 foot to several feet of stratified loam to silty clay, with thin lenses of silt to fine sand or gravelly sandy loam. It is 2.5Y or 5Y hue, value of 4 or 5, and chroma of 0 through 2.

Bono soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Fulton soils and the moderately well drained Lucas soils. The very poorly drained Toledo soils, which have a thinner, darker surface layer than Bono soils, are also in this drainage sequence.

Bono soils occupy positions similar to those of Lenawee, Paulding, and Wallkill soils. They have a slightly more clayey and a slightly thicker, dark surface layer than Lenawee soils. They are less clayey throughout and have a darker surface layer than Paulding soils. Bono soils differ from Wallkill soils in having clayey instead of organic lower horizons.

Bp—Bono silty clay loam. This soil occurs in oval or long depressional areas on the Fort Wayne and Wabash Moraines and on the till plain. The surface crusts after heavy rains and cracks when dry.

Included with this soil in mapping are small areas of Pewamo soils that formed in glacial till. Also included are small areas of Mermill and Millgrove soils near the edge of the areas. Some areas of Wallkill soils near the center of the depressions are also included.

Wetness is the major limitation for farming. The soil dries out slowly in spring. It is commonly plowed before optimum moisture is reached, which adversely affects soil tilth and surface structure. Seasonal wet-

ness and slow to very slow permeability are limitations for many nonfarm uses.

Most areas are used for cultivated crops or pasture. A few areas remain wooded. This soil is well suited to farming if excess water is removed. It has severe limitations for most recreational and urban developments. Capability unit IIIw-2; woodland suitability 3w.

Boyer Series

The Boyer series consists of well drained, gently sloping to moderately steep soils. These soils are mainly on outwash plains and stream terraces and less commonly on beach ridges and moraines. They formed in water deposited loamy and sandy material over gravel and sand.

In a representative profile the surface layer is dark grayish brown loamy sand 11 inches thick. The upper part of the subsoil, from 11 to 19 inches, is yellowish brown loamy sand. The lower part, from 19 to 31 inches, is brown gravelly sandy loam. The substratum to a depth of 60 inches is light yellowish brown and pale brown sand and gravel.

Boyer soils have a moderately deep root zone but have a low available water capacity and are droughty during prolonged dry periods. The surface layer is low in organic-matter content. Permeability is moderately rapid.

These soils are moderately well suited to farming. They are well suited to openland wildlife and woodland. Limitations for nonfarm uses range from slight to severe.

Most areas have been cleared and are used for cultivated crops and meadow, especially corn, wheat, and alfalfa. If irrigated, these soils are well suited to truck crops and to orchards and small fruit production.

Representative profile of Boyer loamy sand, 1 to 6 percent slopes, in a cultivated field SE¼SE¼SE¼ sec. 32 St. Joseph Township; T. 6 N., R. 1 E., 55 feet west of cemetery fence and 25 feet south of County Road A-3:

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) loamy sand; moderate thick platy structure parting to moderate fine subangular blocky; friable; many fine roots; some material from B1 horizon mixed in bottom 2 inches of horizon; 5 percent fine gravel; slightly acid; abrupt smooth boundary

B1—11 to 19 inches; yellowish brown (10YR 5/4) gravelly loamy sand; weak medium subangular blocky structure; very friable; common fine roots; 15 to 20 percent fine and coarse gravel; neutral; clear wavy boundary.

B2t—19 to 31 inches; brown (7.5YR 4/4) gravelly sandy loam; weak fine and medium subangular blocky structure; friable; few fine roots; thin patchy clay films on vertical and horizontal faces of peds; 20 to 25 percent fine and coarse gravel; neutral; abrupt irregular boundary.

IIC1—31 to 40 inches; light yellowish brown (10YR 6/4) sandy gravel; single grained; loose; 60 to 70 percent fine and coarse gravel; calcareous; moderately alkaline; abrupt wavy boundary.

IIC2—40 to 60 inches; pale brown (10YR 6/3) gravelly sand; single grained; loose; 45 percent fine and coarse gravel; calcareous; mildly alkaline.

The depth to carbonates and the solum thickness range from 22 to 37 inches. Gravel content in the solum ranges from 2 to 25 percent.

The Ap horizon is 10YR hue, value of 4, and chroma of 2 or 3. Very dark grayish brown (10YR 3/2) coatings are common. The texture is loamy sand or gravelly loamy sand. Reaction ranges from medium acid to neutral.

The B2 horizon is 10YR through 5YR hue, value of 4 or 5, and chroma of 3 through 6. The texture is sandy loam or sandy clay loam and in places is gravelly. Reaction ranges from medium acid to neutral.

The IIC horizon is several feet of stratified sand and gravel. It is 10YR hue, value of 5 or 6, and chroma of 3 or 4. The gravel content in individual strata ranges from 0 to more than 50 percent. Reaction is mildly or moderately alkaline. This horizon is calcareous.

Boyer soils are the well drained members of a drainage sequence that also includes the well drained Oshtemo soils and the very poorly drained Gilford soils. They have a thinner solum but are otherwise similar to Oshtemo and Belmore soils. They contain less clay in the subsoil and have better drainage than the nearby Haney soils.

BrB—Boyer loamy sand, 1 to 6 percent slopes. This gently sloping soil occurs as broad areas on stream terraces or as narrow strips on beach ridges and moraines. It has the profile described as representative of the series. It is very friable, has good tilth, and is easy to keep in good tilth.

Included with this soil in mapping are small areas of Oshtemo soils. Also included are small areas of the moderately well drained Haney soils in depressions.

Droughtiness is the major limitation for farming. Soil blowing is also a hazard. Moderately rapid permeability and droughtiness are limitations for some nonfarm uses.

This soil is moderately well suited to farming. Most areas have been cleared and are used for cultivated crops and meadow. Capability unit IIIs-1; woodland suitability 3s.

BrC—Boyer loamy sand, 6 to 12 percent slopes. This sloping soil is on stream terraces, beach ridges, and moraines in the northwestern part of the county. It generally occurs as long strips on slope breaks. Runoff is moderate to high despite the high infiltration. Because of erosion, this soil has a thinner surface layer than is described as representative of the series.

Included with this soil in mapping are small areas of Oshtemo soils and a few spots of less sloping Boyer soils.

The severe erosion hazard is the major limitation for farming. Droughtiness is a hazard to crops that mature late in the season. Slope and erosion are the major limitations for nonfarm uses. The sandy texture is a limitation for some recreational uses.

This soil is moderately well suited to farming if erosion is controlled. Most areas have been cleared and

are used for cultivated crops and meadow. Capability unit IIIe-4; woodland suitability 3s.

BoD—Boyer gravelly loamy sand, 12 to 18 percent slopes. This moderately steep soil is in the northwestern part of the county on the Wabash Moraine. The topography is rolling to hilly, and slopes are short and complex. This soil has a slightly thinner surface layer and subsoil and a more gravelly surface layer than is described as representative of the series.

Included with this soil in mapping are small nongravelly areas and spots of Oshtemo, Rawson, and Glynwood soils, which are nearby on similar landscapes.

A severe erosion hazard is the major limitation for farming. Droughtiness is a limitation in most years. Slope and erosion are limitations for most nonfarm uses.

This soil is poorly suited to farming because of the severe erosion hazard and the droughtiness. Most areas have been cleared and are used for cultivated crops and meadow. Capability unit IVe-2; woodland suitability 3s.

Carlisle Series

The Carlisle series consists of very poorly drained, thick organic soils. These soils formed in woody and fibrous organic materials that are the remains of plant and shrub vegetation. They occur in low depressions or bog areas.

In a representative profile the upper 37 inches is black muck. Below this, to a depth of 66 inches, is very dark grayish brown muck.

Carlisle soils have a deep root zone if the soils have been artificially drained. They have a high available water capacity and a very high organic-matter content. Permeability is moderately slow to moderately rapid. The organic surface is susceptible to soil blowing when dry. Ponding is common unless the soil is artificially drained.

Carlisle soils are well suited to row crops if excess water is removed. They are also well suited to wetland wildlife. Limitations for most nonfarm uses are severe. The soils are poorly suited to woodland.

Some areas are used for cultivated crops, but most are still in the original bog condition or are cleared and pastured.

Representative profile of Carlisle muck in a cultivated field SE¼SE¼NW¼SE¼ sec. 15, Bridgewater Township; T. 9 S., R. 3 W., 200 feet north of County Road R:

Oap—0 to 7 inches; black (N 2/0) sapric material; less than 5 percent fibers, less than 1 percent rubbed; moderate medium granular structure; friable; common fine casts; 40 percent mineral content; neutral; abrupt smooth boundary.

Oa2—7 to 17 inches; black (N 2/0) sapric material; less than 30 percent fibers, less than 5 percent rubbed; massive; friable; few fine mineral coats along vertical cracks in upper 3 inches; slightly acid; clear smooth boundary.

Oa3—17 to 24 inches; black (N 2/0) sapric material; 15 to 20 percent fibers, less than 5 percent rubbed; massive; friable; slightly acid; clear smooth boundary.

Oa4—24 to 37 inches; black (N 2/0) sapric material; 30 percent fibers, 5 to 10 percent rubbed; moderate medium platy structure; friable; slightly acid; abrupt smooth boundary.

Oa5—37 to 66 inches; very dark grayish brown (10YR 3/2) sapric material, dark yellowish brown (10YR 4/4) pressed and rubbed; less than 40 percent fibers, 8 to 10 percent rubbed; massive; friable; 2- to 3-inch layer at 44 inches is 40 percent fibers and 10 to 15 percent rubbed; mildly alkaline.

The thickness of the organic deposits ranges from 51 inches to 20 feet or more. A few woody fragments occur throughout the profile in most pedons. Some individual layers meet the requirements for a hemic layer, but their total thickness is less than 10 inches.

The surface layer is 5Y hue or is neutral with value of 2 or 3, and chroma of 0 through 2. Reaction ranges from slightly acid to medium acid.

The subsurface layer is 5YR through 10YR hue or neutral, value of 2 or 3, and chroma of 0 through 2. It ranges from medium acid to neutral.

The bottom layer is 5YR through 10YR hue, value of 2 through 4, and chroma of 0 through 4. Some areas are underlain by olive peat materials with hue of 2.5Y or 5Y. Reaction ranges from medium acid to mildly alkaline.

Carlisle soils are similar to Edwards and Martisco soils, but the organic material is thicker. They do not have marl, which occurs below depths of 16 to 46 inches in Edwards soils and below 8 to 16 inches in Martisco soils. Carlisle soils differ from the nearby Wallkill soils because they lack mineral upper layers.

Ca—Carlisle muck. This soil is in oval or long swampy depressions. Areas range from 2 to about 100 acres in size. Subsidence and soil blowing are problems in cleared and drained areas.

Included with this soil in mapping are narrow strips of Wallkill soils near the edges of depressions. Also included are small areas of Edwards soils, which have marl underlying the muck. In a few areas the muck is underlain by clayey or sandy materials at shallow depths. Also included are strips of Mermill or Millgrove soils where sand and gravel occur around the edge of depressions.

Seasonal wetness and ponding are the major limitations for farming. Subsidence occurs when the soil is drained and may cause tile drain displacement. Lowering the water table also accelerates oxidation of the organic surface. Soil blowing and burning are other hazards when the soil is drained for farming. A seasonal high water table, ponding, and low stability of organic materials are limitations for most nonfarm uses.

This unit is poorly suited to farming unless drained. Once drained, it is very productive for most commonly grown crops and certain special crops. Some areas are used for cultivated crops, but most areas are still in the original bog condition or are cleared and pastured. Capability unit IIIw-4; woodland suitability 4w.

Ceresco Series

The Ceresco series consists of nearly level, somewhat poorly drained soils formed in alluvium.

In a representative profile the surface layer is very dark grayish brown sandy loam 10 inches thick. The subsoil, from 10 to 16 inches, is sandy loam that has dark grayish brown coatings on the faces of natural aggregates. From 16 to 24 inches, the subsoil is mottled, grayish brown sandy loam. The substratum, from 24 to 60 inches, is grayish brown, strong brown, and dark gray stratified loamy sand, sand, and sand and gravel.

Ceresco soils have a deep root zone and a moderate available water capacity. Permeability is moderate or moderately rapid. These soils are subject to flooding, especially in winter and spring. Soil erosion and deposition can occur separately or together during flooding periods.

Ceresco soils are well suited to farming if excess water is removed and they are protected from flooding. A seasonal high water table and the hazard of flooding are severe limitations for most nonfarm uses.

Most areas are still wooded or have been cleared and are used for pasture. Some are used for cultivated crops. These soils are seldom used for wheat or other winter grains because of the hazard of flooding.

Representative profile of Ceresco sandy loam in a cultivated field SW¼SW¼SE¼SW¼ sec. 10, Pulaski Township; T. 6 N., R. 3 E., 35 feet east of field boundary:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) sandy loam; moderate medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

B1—10 to 16 inches; dark brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; friable; few fine roots; dark grayish brown (10YR 4/2) coatings on faces of peds; few medium and fine black (10YR 2/1) organic stains and concretions; neutral; clear smooth boundary.

B2g—16 to 24 inches; grayish brown (10YR 5/2) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; very weak medium subangular blocky structure; firm; few fine roots; few fine very dark grayish brown (10YR 3/2) organic stains; mildly alkaline; gradual wavy boundary.

C1g—24 to 44 inches; grayish brown (10YR 5/2) loamy sand; few medium faint gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/4) mottles; single grained; loose; many medium dark brown (7.5YR 4/4) stains; calcareous; moderately alkaline; clear smooth boundary.

C2—44 to 48 inches; strong brown (7.5YR 5/6) sand; common medium distinct grayish brown (10YR 5/2) mottles; single grained; loose; calcareous; moderately alkaline; clear smooth boundary.

C3g—48 to 60 inches; dark gray (10YR 4/1) sand and gravel with thin (less than 1 inch) clay loam layers high in organic-matter content; single grained; loose; calcareous; moderately alkaline.

The depth to carbonates ranges from 24 to 42 inches. Reaction ranges from slightly acid to mildly alkaline above these depths.

The A horizon is 10 to 14 inches thick and is 10YR hue, value of 2 or 3, and chroma of 1 or 2.

The B horizon is 10YR or 2.5Y hue, value of 4 or 5, and chroma of 2 through 4. The texture ranges from loamy sand to loam. Most profiles have darkened layers, buried organic matter, or buried wood fragments.

The C horizon is 10YR hue, with value of 3 through 5 and chroma of 1 through 6. The texture is stratified and ranges from sand to loam.

Ceresco soils are the somewhat poorly drained members of a drainage sequence that includes the well drained to moderately well drained Landes and the very poorly drained Cohoctah soils. They are more sandy than the Shoals soils that lie in similar positions.

Ce—Ceresco sandy loam. This nearly level soil is on flood plains. It occurs as long, moderate to large areas along drainageways. Most areas are slightly undulating. There is very little surface runoff, and ponding is common. In times of flooding, this soil is one of the first to be flooded.

Included with this soil in mapping are narrow strips and small patches of the wetter Cohoctah soil. Also included are spots of Landes soils on slight rises. A few areas have a thinner and slightly lighter colored surface layer.

Flooding and seasonal wetness are major limitations for farming. Wetness commonly delays spring tillage and planting, but late crops can be grown in most years. Flooding and a seasonal high water table are the dominant limitations for most nonfarm uses.

Most areas of this soil are still wooded or have been cleared and used for pasture. Some areas are used for cultivated crops. This soil is well suited to cultivated crops if adequately drained and protected from flooding. Capability unit IIw-2; woodland suitability 2w.

Cohoctah Series

The Cohoctah series consists of nearly level, very poorly drained soils formed in alluvium along streams.

In a representative profile the surface layer is very dark grayish brown loam 12 inches thick. The subsoil, from 12 to 25 inches, is mottled, dark grayish brown loam. The substratum to a depth of 60 inches is stratified dark grayish brown, dark gray, and brown loamy sand, gravelly sandy loam, and loam. It is mottled in shades of brown.

Cohoctah soils have a deep root zone when the water table is low and a moderate available water capacity. Permeability is moderately rapid. These soils are subject to flooding, especially in winter and spring.

Cohoctah soils are well suited to farming if the excess water is removed and they are protected from flooding. They are well suited to wetland wildlife. Wetness and the hazard of flooding are severe limitations for most nonfarm uses.

Most areas are wooded. Some are used for crops.

Representative profile of Cohoctah loam in a cultivated field NW¼NW¼NW¼ sec. 26, Florence Township; T. 7 N., R. 1 E., 250 feet south of County Road 1 and 50 feet west of creek:

Ap—0 to 12 inches; very dark gray (10YR 3/1) loam, moderate medium granular structure; friable; many fine roots; mildly alkaline; clear smooth boundary.

B21g—12 to 17 inches; dark grayish brown (10YR 4/2) light loam; common medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; friable; common fine roots; mildly alkaline; clear smooth boundary.

B22g—17 to 25 inches; dark grayish brown (10YR 4/2) loam; common fine distinct grayish brown (2.5YR 5/2) and dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; common medium distinct very dark grayish brown (10YR 3/2) coatings in root channels and on faces of peds; mildly alkaline; abrupt smooth boundary.

C1—25 to 48 inches; stratified dark grayish brown (10YR 4/2), dark gray (10YR 4/1), and brown (10YR 5/3) loamy sand and loam; common medium distinct dark brown (7.5YR 4/4) and grayish brown (2.5Y 5/2) mottles; weak medium platy structure; friable; few buried sticks at 42 to 44 inches; mildly alkaline; clear smooth boundary.

C2—48 to 60 inches; dark grayish brown (10YR 4/2) gravelly sandy loam; common medium distinct dark brown (7.5YR 4/4) and dark yellowish brown (10YR 4/4) mottles; massive; very friable; calcareous; mildly alkaline.

Depth to carbonates ranges from 30 to 60 inches. The thickness of the solum ranges from 12 to 32 inches.

The A horizon is 10 to 14 inches thick and is 10YR hue, value of 2 or 3, and chroma of 1. Reaction ranges from slightly acid to mildly alkaline.

The B horizon is 10YR hue, value of 3 through 5, and chroma of 1 or 2. The texture ranges from sandy loam to loam. Reaction is neutral or mildly alkaline.

The C horizon is 10YR hue, value of 3 through 5, and chroma of 1 or 2. The texture ranges from sand to loam and in some areas is gravelly.

Cohoctah soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Ceresco and the well drained to moderately well drained Landes soils. Cohoctah soils have a higher sand content than Sloan soils, which also occur on the flood plain.

Ch—Cohoctah loam. This soil occurs as long, moderately wide strips on flood plains and on the entire flood plain along some small tributaries. It can easily be tilled. The surface layer has good structure and tilth.

Included with this soil in mapping are small areas of Sloan soils that range from 1 to several acres in size. Spots of Ceresco soils occur on slight rises and near streambanks in some places.

Flooding and seasonal wetness are the major limitations for farming. Wetness commonly delays spring tillage and planting, but summer crops can be grown if the soils are artificially drained. Flooding and the seasonal high water table are the dominant limitations for most nonfarm uses.

Most areas are wooded, and a few areas are cropped. This soil is well suited to farming if excess water is removed and it is properly protected from flooding. It has severe limitations for most recreational and urban developments. Capability unit IIIw-1; woodland suitability 2w.

Colwood Series

The Colwood series consists of very poorly drained soils formed in silty or loamy materials over stratified material of mostly silt to very fine sand. These level soils occupy broad upland areas on the lake plain and outwash plains.

In a representative profile the surface layer is very dark grayish brown silt loam 14 inches thick. The subsoil, from 14 to 26 inches, is mottled, grayish brown silt loam, and from 26 to 49 inches, is mottled, grayish brown and yellowish brown clay loam. The substratum to a depth of 60 inches is mottled, yellowish brown stratified clay loam, very fine sand, silt, and silty clay loam.

Colwood soils have a deep root zone when the water table is low. They have a seasonal high water table and are saturated for long periods in winter and spring. Available water capacity is high. Permeability is moderate throughout. Some ponding occurs during periods of heavy rainfall, but the water infiltrates the soil rather quickly. Very little surface runoff occurs on these soils.

Colwood soils are well suited to farming if the excess water is removed. They are well suited for wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas are used for crops. Some remain wooded.

Representative profile of Colwood silt loam in a cultivated field NE¼SW¼SW¼SE¼ sec. 28, Brady Township; T. 7 N., R. 4 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; friable; many fine roots; mildly alkaline; abrupt smooth boundary.

A12—10 to 14 inches; very dark grayish brown (10YR 3/2) silt loam; common fine distinct dark yellowish brown (10YR 4/4) and dark brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; friable; many fine roots; very dark gray (10YR 3/1) coatings on faces of peds; few fine black (10YR 2/1) concretions; neutral; abrupt smooth boundary.

B21g—14 to 26 inches; grayish brown (2.5Y 5/2) silt loam; common fine distinct yellowish brown (10YR 5/4) and dark gray (10YR 4/1) mottles; moderate medium and fine angular blocky structure; firm; few fine roots; grayish brown (10YR 5/2) coatings on faces of peds; few fine

black (10YR 2/1) concretions; neutral; gradual wavy boundary.

B22g—26 to 37 inches; grayish brown (2.5Y 5/2) clay loam; common medium distinct yellowish brown (10YR 5/4) and dark brown (7.5YR 4/4) mottles; moderate medium angular blocky structure parting to moderate very fine angular blocky; firm; few fine roots; grayish brown (10YR 5/2) coatings on faces of peds; few fine black (10YR 2/1) concretions; mildly alkaline; gradual wavy boundary.

B23—37 to 49 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; firm; grayish brown (10YR 5/2) coatings on faces of peds; few fine black (10YR 2/1) concretions; mildly alkaline; gradual wavy boundary.

C—49 to 60 inches; yellowish brown (10YR 5/4) stratified clay loam, very fine sand, silt, and silty clay loam; common medium distinct gray (10YR 5/1) mottles; weak medium platy structure in stratification; firm; calcareous; moderately alkaline.

The depth to carbonates ranges from 35 to 45 inches. The thickness of the solum ranges from 35 to 50 inches.

The A horizon is generally 10 to 15 inches thick and is black, very dark gray, or very dark grayish brown in 10YR hue, value of 2 or 3, and chroma of 1 or 2. Reaction ranges from slightly acid to mildly alkaline.

The B horizon is 10YR or 2.5Y hue, value of 5 or 6, and chroma of 1 through 4. The texture is loam, heavy fine sandy loam, clay loam, light silty clay loam, or silt loam. Reaction ranges from neutral to mildly alkaline.

The C horizon is 10YR or 2.5Y hue, value of 5 or 6, and chroma of 1 through 4. The texture is mainly fine sand, very fine sand, and silt loam but includes thin strata of clay loam and silty clay loam. Reaction is moderately alkaline. This horizon is calcareous.

Colwood soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Kibbie soils and the moderately well drained Tuscola variant. Colwood soils are on positions similar to Lenawee and Lamson soils. They are less clayey and have more strata of silt and fine sand than Lenawee soils but have a thicker and darker surface layer and have a higher clay content than Lamson soils. Colwood soils are similar to Gilford and Millgrove soils but have more strata of silt and fine sand. They also have more clay than Gilford soils.

Cp—Colwood silt loam. This level soil occupies broad areas on the lake plain and glacial outwash plains. The surface layer has good tilth, although crusting is common.

Included with this soil in mapping are small lighter colored areas of the somewhat poorly drained Kibbie soils on small knolls. Also included are small areas of the finer textured Lenawee soils. A few areas have a loam surface layer.

Seasonal wetness is the dominant limitation for farming. A seasonal high water table is the major limitation for most nonfarm uses.

Most areas are used for crops. Some are wooded. This soil is well suited to farming if the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw–6; woodland suitability 2w.

Del Rey Series

The Del Rey series consists of nearly level and gently sloping, somewhat poorly drained soils that formed in medium to fine textured stratified lake sediments. These soils occur on the lake plain and in slack water areas in the western part of the county.

In a representative profile the surface layer is dark gray silty clay loam 10 inches thick. The subsoil, from 10 to 46 inches, is mottled, dark yellowish brown and brown silty clay and silty clay loam. The substratum to a depth of 66 inches is mottled, brown clay loam.

Del Rey soils have a deep root zone and a high available water capacity. Permeability is slow in the subsoil and substratum. The soils are saturated for significant periods in winter and spring and dry slowly unless adequately drained.

Del Rey soils are moderately well suited to farming if excess water is removed. They are well suited to openland wildlife. Limitations for most nonfarm uses are moderate or severe.

Most areas are used for crops. Some are wooded.

Representative profile of Del Rey silty clay loam, 0 to 2 percent slopes, in a cultivated field SW¼SE¼ SW¼NE¼ sec. 15, Brady Township; T. 7 N., R. 4 E., 40 feet east of County Road 22–J and 45 feet north of field boundary:

Ap—0 to 10 inches; dark gray (10YR 4/1) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

B21t—10 to 16 inches; dark yellowish brown (10YR 4/4) silty clay; common fine distinct gray (10YR 5/1) and yellowish brown (10YR 5/4) mottles; moderate medium angular blocky structure parting to weak fine angular blocky; firm; few fine roots; gray (5Y 5/1) ped surfaces; thin patchy clay films on vertical faces of peds; slightly acid; gradual wavy boundary.

B22t—16 to 27 inches; brown (10YR 4/3) silty clay loam; common fine distinct gray (10YR 5/1) and yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure parting to moderate medium angular blocky; firm; few fine roots; gray (10YR 5/1) ped surfaces; thin patchy clay films on faces of peds; neutral; abrupt wavy boundary.

B3t—27 to 46 inches; brown (10YR 4/3) silty clay loam; common fine distinct gray (N 5/0) and grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; gray (5Y 5/1)

ped surfaces; thin patchy clay films on faces of peds; thin seams of silt loam and silt; few fine distinct light gray (10YR 7/1) lime segregations; calcareous; moderately alkaline; abrupt wavy boundary.

C—46 to 66 inches; brown (10YR 4/3) clay loam; common fine distinct gray (10YR 5/1) and few medium distinct yellowish brown (10YR 5/4) mottles; massive; firm; few vertical cleavages with gray (N 6/0) cleavage faces; thin seams of sand and silt; calcareous; moderately alkaline.

The depth to carbonates ranges from 26 to 44 inches. The thickness of the solum ranges from 30 to 48 inches.

The A horizon, generally 5 to 9 inches thick, is 10YR hue, value of 4, and chroma of 1 or 2. The texture is loam or silty clay loam. Reaction ranges from medium acid to slightly acid and in places is neutral in limed areas.

The B horizon is 10YR or 2.5Y hue, value of 4 through 6, and chroma or 2 through 4 and is mottled. The texture is silty clay loam or silty clay with some thin strata of clay loam or clay. Reaction ranges from slightly acid to moderately alkaline. In places this horizon is calcareous in the lower part.

The C horizon is commonly stratified with silt loam, silty clay loam, clay loam, clay, and silty clay with thin strata of silt and fine sand. It is 10YR or 2.5Y hue, value of 4 through 6, and chroma of 0 through 6. Reaction is moderately alkaline. This horizon is calcareous.

Del Rey soils are the somewhat poorly drained members of a drainage sequence that includes the very poorly drained Lenawee and the moderately well drained Shinrock soils. Del Rey soils are less clayey in the subsoil and substratum than the similar Fulton soils. In contrast with the nearby Blount and Nappanee soils, they are stratified and do not have glacial pebbles.

DeA—Del Rey loam, 0 to 2 percent slopes. This nearly level soil is principally on the lake plain in the vicinity of Stryker. It is also in slack water areas along the St. Joseph River and in the western part of the county. In some areas this soil occurs as strips parallel to drainageways. In other areas it is on broad flats and some low knolls. Surface runoff is slow, and ponding is common. The profile is similar to the one described as representative of the series, but the surface layer is loam, is less susceptible to crusting, and has better tilth.

Included with this soil in mapping are narrow strips of the very poorly drained Lenawee soils. Also included are sandy areas that are identified by spot symbols on the soil map. These areas are along the St. Joseph River where nearby sandy and gravelly soils are mapped.

Seasonal wetness is the major limitation for farming. Some erosion hazard exists, but this is mainly from soil blowing. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas of this soil are used for crops. A few are wooded. This soil is well suited to farming if the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw-5; woodland suitability 3w.

DeB—Del Rey loam, 2 to 6 percent slopes. This gently sloping soil is on the lake plain in the vicinity of Stryker and in slack water areas along the St. Joseph River and in the western part of the county. It occurs as long strips adjacent to drainageways or is on low rises and knolls. Surface runoff is medium, and soil erosion is a hazard. This soil has a profile similar to the one described as representative of the series, but the surface layer is loam, has better tilth, and is less susceptible to crusting.

Included with this soil in mapping are narrow strips and small areas of the very poorly drained Lenawee soils. Also included are small sandy areas that are identified by spot symbols on the soil map. Areas with a sandy and gravelly substratum are also included. These areas are along the St. Joseph River near sandy and gravelly soils.

The erosion hazard is the major limitation for farming, but seasonal wetness also limits use. Erosion control practices and drainage are needed for farming. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas are used for crops. A few are wooded. This soil is well suited to farming if the excess water is removed and it is protected from erosion. It has moderate to severe limitations for recreational and urban developments. Capability unit IIe-4; woodland suitability 3w.

DfA—Del Rey silty clay loam, 0 to 2 percent slopes. This nearly level soil occurs principally on the lake plain. It commonly occurs as long strips that parallel drainageways or border very poorly drained areas. It is on low knolls and broad flats. Surface runoff is slow, and ponding is common. This soil has the profile described as representative of the series. The surface layer is susceptible to crusting and clodding if plowed when wet.

Included with this soil in mapping are narrow strips of the very poorly drained Lenawee soils. Also included are small areas of the finer textured Fulton soils and the coarser textured Kibbie soils.

Seasonal wetness is the major limitation for farming. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas of this soil are used for crops. A few are wooded. This soil is well suited to farming if the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw-5; woodland suitability 3w.

DfB—Del Rey silty clay loam, 2 to 6 percent slopes. This gently sloping soil occupies areas on lake plains. It occurs as long strips adjacent to drainageways or is on low rises and knolls. Runoff is medium. The surface layer is susceptible to crusting and clodding if plowed when wet.

Included with this soil in mapping are narrow strips and small areas of the very poorly drained Lenawee soils. Also included, at higher elevations, are spots of the moderately well drained Shinrock soil. Small areas of the finer textured Fulton soils and the coarser textured Kibbie soils are included in some areas.

The erosion hazard is the major limitation for farm-

ing, but seasonal wetness also limits use. Erosion control and proper drainage are needed. Soil wetness and slow permeability are limitations for many nonfarm uses.

Most areas are used for crops. A few are wooded. This soil is well suited to farming if the excess water is removed and it is protected from erosion. It has moderate to severe limitations for recreational and urban developments. Capability unit IIe-4; woodland suitability 3w.

Digby Series

The Digby series consists of nearly level and gently sloping, somewhat poorly drained soils. These soils formed in loamy outwash over poorly stratified gravel and sand containing some fine material. They occur on beach ridges, outwash plains, and stream terraces.

In a representative profile the surface layer is dark grayish brown loam 9 inches thick. The subsurface layer, from 9 to 12 inches, is mottled, brown loam. The subsoil, from 12 to 37 inches, is mottled, grayish brown and dark grayish brown loam and clay loam. The substratum to a depth of 60 inches is pale brown and grayish brown stratified gravelly sandy loam and sand.

Digby soils have a deep root zone and a moderate available water capacity. Permeability is moderate in the subsoil and rapid in the substratum. The soils are saturated for significant periods in winter and spring and dry slowly unless adequately drained.

Digby soils are well suited to farming if the excess water is removed. They are well suited to openland wildlife. Limitations for many nonfarm uses are moderate to severe.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Digby loam, 0 to 3 percent slopes, in a cultivated field SW¼SE¼SW¼NE¼ sec. 28, Jefferson Township; T. 7 N., R. 3 E., 30 feet south of east-west fence and 25 feet west of north-south fence:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; weak coarse subangular blocky structure parting to moderate fine granular; friable; many fine and medium roots; very dark grayish brown (10YR 3/2) coatings; 2 percent gravel; neutral; abrupt smooth boundary.

A2—9 to 12 inches; brown (10YR 5/3) loam; many fine faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to weak fine subangular blocky; friable; few fine and medium roots; 2 percent gravel; neutral; gradual wavy boundary.

B21tg—12 to 20 inches; grayish brown (10YR 5/2) loam; few medium faint yellowish brown (10YR 5/4) mottles; weak coarse and medium subangular blocky structure; friable; few fine roots; thin patchy dark grayish brown (10YR 4/2) clay films on horizontal and vertical faces of peds; 5 percent gravel; neutral; clear wavy boundary.

B22tg—20 to 30 inches; dark grayish brown (2.5Y 4/2) clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; moderate coarse and fine subangular blocky structure; firm; few fine roots; medium continuous dark grayish brown (10YR 4/2) clay films on horizontal and vertical faces of peds; 5 to 10 percent gravel; few medium distinct black (10YR 2/1) concretions; mildly alkaline; abrupt smooth boundary.

B3tg—30 to 37 inches; dark grayish brown (10YR 4/2) loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds; 5 percent gravel; mildly alkaline; abrupt smooth boundary.

IIC—37 to 60 inches; pale brown (10YR 6/3) and grayish brown (10YR 5/2) stratified gravelly sandy loam and sand; single grained; loose; some loam and silt seams 1 to 4 inches thick; 25 percent gravel; calcareous; moderately alkaline.

The depth to carbonates and the thickness of the solum range from 25 to 40 inches. The gravel content in the solum ranges from 2 to 40 percent.

The Ap horizon ranges from 7 to 11 inches in thickness and is 10YR hue, value of 4 or 5, and chroma of 1 or 2. The texture is loam or sandy loam. Reaction ranges from slightly acid to neutral.

The B horizon is 10YR or 2.5Y hue, value of 4 or 5, and chroma of 2 through 4. It is mottled. The texture is fine sandy loam, loam, sandy clay loam, or clay loam. Reaction ranges from slightly acid to mildly alkaline.

The IIC horizon is 10YR or 2.5Y hue, value of 4 through 6, and chroma of 2 through 4. The texture ranges from sand to sandy loam and their gravelly analogs. Thin seams of loam and silt loam are common. The gravel content ranges from 5 to 40 percent. Fine textured lacustrine or glacial till occurs below 4 feet in some areas.

Digby soils are the somewhat poorly drained members of a drainage sequence that includes the well drained Belmore soils, the moderately well drained Haney soils, and the very poorly drained Millgrove soils. Digby soils resemble Haskins soils in the upper part of the profile, but the lower part of Haskins soils is finer textured. Digby soils are similar to Kibbie soils but have more sand and gravel throughout.

DgA—Digby sandy loam, 0 to 3 percent slopes. This nearly level to gently sloping soil is on beach ridges, stream terraces, and outwash plains. It occurs in long strips, on low knolls, or in flats. This soil has more sand in the surface and subsurface layers than is described as representative of the series. It also has a higher rainfall infiltration rate and a lower available water capacity.

Included with this soil in mapping are narrow strips of the wetter Millgrove soils along natural drainageways. Also included are small areas of Haskins soils, which are commonly adjacent to finer textured soils.

Seasonal wetness is the major limitation for farming. Erosion is a minor hazard on the more sloping

areas. Seasonal wetness is a limitation for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is well suited to cultivated crops if the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw-3; woodland suitability 2w.

DmA—Digby loam, 0 to 3 percent slopes. This nearly level to gently sloping soil occurs as long strips along drainageways or on knolls or flats. It has the profile described as representative of the series.

Included with this soil in mapping are narrow areas along natural drainageways of the wetter Millgrove soils. Also included are small areas of Haskins soils, which are commonly along the edge of this soil where it borders finer textured soils. Spots of the finer textured Blount and Del Rey soils are included in some areas.

Seasonal wetness is the major limitation for farming. Erosion is a minor hazard on the more sloping areas. Seasonal wetness is also a limitation for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is well suited to cultivated crops if the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw-3; woodland suitability 2w.

Edwards Series

The Edwards series consists of very poorly drained organic soils underlain by marl. These soils are in marshes, swamps, and bogs. They formed in woody and fibrous organic material.

In a representative profile the upper 9 inches is very dark brown muck. Below this to a depth of 27 inches is black and very dark grayish brown muck. From 27 to 60 inches is gray and light brownish gray marl.

These soils have a moderately deep root zone when they have been artificially drained. Available water capacity is high. Permeability is moderately slow to moderately rapid in the muck layers but is variable in the underlying marl. Unless drained, these soils are saturated during most of the year. Ponding is common.

Edwards soils are well suited to row or truck crops if excess water is removed and the surface is protected from soil blowing. They are well suited to wetland wildlife but are poorly suited to woodland. Limitations for nonfarm uses are severe.

Most areas are still in the original bog condition. Some are cleared and pastured.

Representative profile of Edwards muck, in a swampy depression SE¼NE¼SE¼SW¼ sec. 7, Bridgewater Township; T. 9 S., R. 2 W., 195 feet west of field boundary and 680 feet north of County Road S:

Oa1—0 to 9 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material; about 10 percent fiber, 5 percent rubbed; moderate fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

Oa2—9 to 17 inches; black (10YR 2/1) broken face and rubbed sapric material; about 15 percent fiber, less than 5 percent rubbed; weak very thick platy structure parting to weak medium subangular blocky; friable; common fine roots; common fine distinct dark brown (7.5YR 3/2) stains on faces of peds; neutral; clear smooth boundary.

Oa3—17 to 27 inches; very dark grayish brown (10YR 3/2) broken face sapric material, very dark gray (10YR 3/1) rubbed; dark gray (10YR 4/1) streaks next to faces of peds; about 15 percent fiber, 10 percent rubbed; weak very thick platy structure parting to weak medium subangular blocky; friable; few fine roots; common coarse distinct dark reddish brown (5YR 3/3) stains; few very small shells below 24 inches; neutral; abrupt smooth boundary.

Lca1—27 to 36 inches; gray (10YR 5/1) marl; massive; friable; many shells; violent effervescence; calcareous; moderately alkaline; gradual wavy boundary.

Lca2—36 to 60 inches; light brownish gray (2.5Y 6/2) marl; massive; friable; violent effervescence; calcareous; moderately alkaline.

The depth to carbonates or the underlying marl ranges from 16 to 46 inches.

The organic layers range from 5YR to 10YR hue, value of 2 or 3, and chroma of 0 through 2. Soil reaction ranges from slightly acid to mildly alkaline. Small shells are commonly found in the organic layer directly above the marl.

The marl is 10YR or 2.5Y hue, value of 5 through 7, and chroma of 1 or 2.

Edwards soils are similar to Carlisle soils, but the organic material is not as thick and they are underlain by marl. They have thicker organic layers over the marl than Martisco soils.

Ed—Edwards muck. This soil is in oval or long swampy depressions. Most areas are small. A few are more than 10 acres in size.

Included with this soil in mapping are narrow areas of Pewamo and Mermill soils. In a few areas of this Edwards soil a mineral layer occurs between the organic material and the marl.

Excess wetness and soil blowing are the major limitations for farming. Ponding is common, and many areas are difficult to drain because they are depressional. When this soil is drained, the subsidence resulting from oxidation and the soil blowing gradually reduce the thickness of the muck layers. A fire hazard also exists in drained areas.

Some areas are used for cultivated crops, but most areas are still in the original bog condition or are cleared and pastured. This soil is poorly suited to farming unless adequately drained. Drained areas are suited to cultivated crops or to truck crops. Limitations are severe for recreational and urban developments. Capability unit IVw-1; woodland suitability 5w.

Eel Series

The Eel series consists of nearly level, moderately well drained soils on flood plains along the larger streams in the county. These soils formed in alluvium from nearby glacial till uplands or lake plain deposits. They are flooded during periods of high water. This flooding usually occurs in winter and spring but can occur at any time.

In a representative profile the surface layer is dark grayish brown loam 8 inches thick. The subsoil, from 8 to 34 inches, is brown and dark yellowish brown loam and silt loam. It is mottled below a depth of 14 inches. The substratum, from 34 to 64 inches, is mottled, brown clay loam.

Eel soils have a deep root zone and a high available water capacity. Permeability is moderate throughout, except in sandy and gravelly layers where it is rapid. Erosion sometimes occurs during floods or is the result of scouring or channeling.

Eel soils are well suited to farming if protected from flooding. Wheat is sometimes damaged by early spring floods. Limitations for most nonfarm uses are severe. These soils are generally well suited to woodland.

Most areas are used for cultivated crops or pasture. A few are wooded.

Representative profile of Eel loam, in a cultivated field NE¼NW¼SW¼NE¼ sec. 22, Brady Township; T. 7 N., R. 4 E., 135 feet west of Tiffin River:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure parting to weak fine granular; friable; many fine roots; mildly alkaline; abrupt smooth boundary.

B21—8 to 14 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure parting to weak fine angular blocky; friable; common fine roots; dark grayish brown (10YR 4/2) organic coating on faces of peds; mildly alkaline; gradual wavy boundary.

B22—14 to 28 inches; dark yellowish brown (10YR 4/4) loam; common fine faint dark grayish brown (10YR 4/2) mottles; weak coarse subangular blocky structure parting to weak fine and medium angular blocky; friable; few fine roots; common very dark grayish brown (10YR 3/2) stains and coatings in root channels; mildly alkaline; gradual wavy boundary.

B23—28 to 34 inches; dark yellowish brown (10YR 4/4) silt loam; common fine faint dark grayish brown (10YR 4/2) mottles; weak coarse subangular blocky structure parting to weak fine angular blocky; friable; few fine roots; dark brown (7.5YR 3/2) stains; very dark grayish brown (10YR 3/2) coatings in root channels; mildly alkaline; gradual wavy boundary.

C1—34 to 50 inches; brown (10YR 5/3) clay loam; common fine distinct dark yellowish brown (10YR 4/4) and dark grayish brown (10YR 4/2) mottles; weak medium and coarse angular blocky structure; few fine roots; yellowish red (5YR 4/6) stains; calcareous; moderately alkaline; gradual wavy boundary.

C2—50 to 64 inches; brown (10YR 5/3) clay loam with seams of sandy loam and silt loam; few fine faint grayish brown (10YR 5/2) and common fine distinct dark brown (7.5YR 3/2) mottles; very weak medium and coarse subangular blocky structure; friable; dark brown (7.5YR 3/2) stains; calcareous; moderately alkaline.

The thickness of the solum ranges from 25 to 44 inches. The depth to free carbonates ranges from 32 to 40 inches.

The A horizon is 8 to 10 inches thick and is 10YR hue, value of 3 through 5, and chroma of 2 or 3. Reaction ranges from neutral to mildly alkaline.

The B horizon is 10YR hue, value of 4 or 5, and chroma of 3 through 6. The texture is typically loam or silt loam but ranges to light silty clay loam or heavy sandy loam. Reaction ranges from neutral to moderately alkaline. In places this horizon is calcareous in the lower part.

The C horizon is 10YR hue, value of 4 or 5, and chroma of 2 through 4. The texture ranges from sandy loam to silty clay loam with strata of sandy and gravelly material. Reaction is moderately alkaline. This horizon is calcareous.

Eel soils are the moderately well drained members of a drainage sequence that includes the well drained Genesse soils, the somewhat poorly drained Shoals soils, and the very poorly drained Sloan soils. Eel soils are similar to Landes soils but contain less sand and more clay.

Eel soils in the survey area have more subsoil development than Eel soils mapped in other areas, but this difference does not affect their use and management.

Ee—Eel loam. This nearly level soil is on flood plains along major streams of the county. Most areas are relatively large in size and long or oval in shape.

Included with this soil in mapping are small areas of the well drained Genesee soil. Also included are narrow areas of Shoals or Sloan soils in swales and low spots.

Flooding is the major limitation for farming. Streambank erosion is also a hazard in some areas. Flooding occurs most commonly in winter and spring, but it can occur in other seasons of the year. Flooding is also a limitation for many nonfarm uses.

Most areas are used for crops and pasture. This soil is well suited to farming if protected from flooding. It has moderate to severe limitations for most recreational and urban developments. Capability unit IIw-1; woodland suitability 1o.

Fulton Series

The Fulton series consists of nearly level and gently sloping, somewhat poorly drained soils. These soils

formed in lake-deposited limy clay that has thin layers, or strata, of coarser textured materials. They occupy areas that were shallow glacial lakes.

In a representative profile the surface layer is dark gray silty clay loam 8 inches thick. The subsoil, from 8 to 37 inches, is mottled, brown and dark yellowish brown silty clay. The substratum to a depth of 62 inches is mottled, brown silty clay lacustrine material.

Fulton soils have a moderately deep root zone and a moderate available water capacity. Permeability is slow or very slow. These soils are saturated for significant periods in winter and spring. They dry slowly in spring unless adequately drained.

Fulton soils are moderately well suited to farming if the excess water is removed. They are well suited to openland wildlife. Limitations for most nonfarm uses are moderate to severe.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Fulton silty clay loam, 0 to 2 percent slopes, in a cultivated field NE¼SE¼-SE¼NE¼ sec. 26, Pulaski Township; T. 6 N., R. 3 E., 245 feet west of County Road 18 and 100 feet north of barn:

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay loam; weak medium subangular blocky structure parting to moderate fine granular; firm; common fine roots; neutral; abrupt smooth boundary.

B21tg—8 to 18 inches; brown (10YR 4/3) silty clay; common fine distinct grayish brown (10YR 5/2) and dark gray (5Y 4/1) mottles; strong medium and fine angular blocky structure; very firm; common fine roots; thin patchy gray (10YR 5/1) clay films on faces of peds; mildly alkaline; gradual wavy boundary.

B22tg—18 to 26 inches; dark yellowish brown (10YR 4/4) silty clay; common fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to strong medium angular blocky; very firm; few fine roots; few fine distinct very dark brown (10YR 2/2) stains; thin patchy dark gray (5Y 4/1) clay films on faces of peds; few light gray (10YR 7/1) lime segregations; mildly alkaline; abrupt smooth boundary.

B3tg—26 to 37 inches; dark yellowish brown (10YR 4/3) silty clay; common fine distinct grayish brown (10YR 5/2) and dark gray (5Y 4/1) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; few fine roots; thin patchy dark gray (5Y 4/1) clay films on faces of peds; light gray lime seams at 26 to 27 inches; calcareous; mildly alkaline; gradual wavy boundary.

C—37 to 62 inches; brown (10YR 4/3) silty clay with thin strata of silty clay loam; common medium distinct gray (10YR 5/1) mottles; weak thin platy structure; very firm; medium patchy gray (5Y 5/1) clay films on vertical cleavage faces; common medium light gray lime segregations on faces of peds; calcareous; moderately alkaline.

The depth to carbonates ranges from 24 to 42 inches. The thickness of the solum ranges from 24 to 44 inches.

The Ap horizon is generally 6 to 10 inches thick and is 10YR hue, value of 4 or 5, and chroma of 1 or 2. The texture is loam or silty clay loam. Reaction is slightly acid or neutral.

The B horizon is 10YR or 2.5Y hue, value of 4 or 5, and chroma of 1 through 4. The texture is silty clay or clay with thin strata of silty clay loam or silt loam in some pedons. Reaction ranges from neutral to mildly alkaline. In places this horizon is calcareous in the lower part.

The C horizon is 10YR or 2.5Y hue, value or 4 or 5, and chroma of 2 through 6. The texture is silty clay or clay. Strata of silty clay loam, silt loam, loam or fine sand occur in some pedons. Clay loam glacial till commonly underlies the C horizon within a depth of 6 feet.

Fulton soils are the somewhat poorly drained members of a drainage sequence that includes the moderately well drained Lucas soils and the very poorly drained Toledo and Bono soils. Fulton soils are similar to Roselms and Del Rey soils. They are less clayey throughout than Roselms soils but are more clayey in the subsoil and substratum than Del Rey soils. In contrast with the nearby Nappanee soils, they formed in more stratified sediments and do not have pebbles and stone fragments.

FsA—Fulton loam, 0 to 2 percent slopes. This nearly level soil is on lake plains. Most areas are long strips that parallel drainageways or occur on slight rises. The profile is similar to the one described as representative of the series, but the surface layer is loam, has better tilth, and is less subject to crusting.

Included with this soil in mapping are small areas of the very poorly drained Toledo and Latty soils. These areas generally occur along natural drainageways, in low spots, and near the edge of this soil. Small areas of Del Rey soils are also included.

Seasonal wetness is the major limitation for farming. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is moderately well suited to farming if the excess water is removed. It is well suited to openland wildlife. It has moderate to severe limitations for recreational and urban developments. Capability unit IIIw-3; woodland suitability 3w.

FsB—Fulton loam, 2 to 6 percent slopes. This gently sloping soil is on the lake plain. It occupies small to moderately large, long strips adjacent to drainageways. Surface runoff is medium, and erosion is a moderate hazard. Ponding rarely occurs. The profile is similar to the one described as representative of the series, but the surface layer is loam, has better tilth, and is less subject to crusting.

Included with this soil in mapping are spots of Fulton silty clay loam soil. Also included are small

areas of Del Rey soils. These areas are mainly near the boundaries between Fulton and Del Rey soils.

Seasonal wetness is the major limitation for farming. An erosion hazard is also a limitation. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is moderately well suited to farming if the erosion hazard can be controlled and the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIIw-3; woodland suitability 3w.

FuA—Fulton silty clay loam, 0 to 2 percent slopes. This nearly level soil is on the lake plain. It occurs as small to moderately large and long strips that parallel drainageways. It is also on slight rises throughout the lake plain. A few large areas are relatively flat. This soil has the profile described as representative of the series. The surface crusts after heavy rainfall, and this adversely affects seedling establishment. Ponding occurs in some places.

Included with this soil in mapping are narrow strips of the very poorly drained Toledo and Latty soils. These areas are commonly along natural drainageways and in low spots. Some small areas of Del Rey soils and a few spots of soils with a loam surface layer are also included.

Seasonal wetness is the major limitation for farming. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is moderately well suited to farming if the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIIw-3; woodland suitability 3w.

FuB—Fulton silty clay loam, 2 to 6 percent slopes. This gently sloping soil is on the lake plain. It commonly occurs as long, narrow to moderately wide strips adjacent to drainageways. Some areas are on low rises and knolls. Runoff is medium, and erosion is a moderate hazard. The surface crusts after heavy rainfall, and this adversely affects seedling establishment.

Included with this soil in mapping are spots of Fulton loam and small areas of Del Rey soils. A few moderately eroded, more sloping spots are also included.

Seasonal wetness and the hazard of erosion are the major limitations for farming. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is moderately well suited to farming if the erosion hazard is controlled and the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIIw-3; woodland suitability 3w.

Genesee Series

The Genesee series consists of nearly level, well drained soils on flood plains along the larger streams in the county. These soils formed in alluvium derived from nearby glacial till or lake plain deposits. They are flooded in periods of high water, mainly in winter and spring.

In a representative profile the surface layer is dark grayish brown loam 8 inches thick. The subsoil, from 8 to 40 inches, is brown clay loam and loam. The substratum to a depth of 60 inches is brown loam.

Genesee soils have a deep root zone and a high available water capacity. Permeability is moderate throughout, except in coarser textured strata in the substratum, where it is rapid. Both erosion and deposition occur during floods, causing streambanks to erode and channels to change.

Genesee soils are well suited to farming if protected from flooding. They are well suited to openland wildlife. Limitations for most nonfarm uses are severe. These soils are well suited to woodland.

Most areas are used for cultivated crops. A few are wooded.

Representative profile of Genesee loam, in a cultivated field SW¼SE¼SW¼ sec. 28, Springfield Township; T. 6 N., R. 4 E., north of U.S. Route 6 on highway right-of-way, 260 feet west of field entrance from highway, 35 feet south of fence:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; moderate medium granular structure; friable; many fine roots; very dark grayish brown coatings on faces of peds; mildly alkaline; abrupt smooth boundary.

B21—8 to 11 inches; brown (10YR 4/3) clay loam; moderate medium angular blocky structure; friable; many fine roots; common medium distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; mildly alkaline; abrupt wavy boundary.

B22—11 to 28 inches; brown (10YR 4/3) clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; friable; common fine roots; black (10YR 2/1) organic stains; mildly alkaline; gradual wavy boundary.

B23—28 to 40 inches; brown (10YR 4/3) loam; weak coarse subangular blocky structure parting to weak medium angular blocky; friable; few fine roots; mildly alkaline; gradual smooth boundary.

C—40 to 60 inches; brown (10YR 4/3) loam; massive, some stratification; friable; calcareous below 49 inches; mildly alkaline.

The thickness of the solum ranges from 25 to 46 inches. The depth to free carbonates ranges from 30 to 50 inches.

The A horizon ranges from 7 to 10 inches in thickness and is 10YR hue, value of 3 through 5, and chroma of 2 or 3. Reaction is neutral or mildly alkaline.

The B horizon is 10YR hue, value of 4 or 5, and chroma of 2 through 4. The texture ranges from sandy loam to silty clay loam with strata of sandy and gravelly material increasing in thickness with depth. Reaction ranges from neutral to moderately alkaline. In places this horizon is calcareous.

Genesee soils are the well drained members of a drainage sequence that includes the moderately well drained Eel soils, the somewhat poorly drained Shoals

soils, and the very poorly drained Sloan soils. Genesee soils are similar to Landes soils but are more clayey and less sandy.

Genesee soils in the survey area have more subsoil development than is defined as the range for Genesee soils, but this difference does not affect use and management.

Ge—Genesee loam. This nearly level soil occupies areas on the flood plains of major streams of the county. Most areas are adjacent to streams and are moderate to large in size and long or oval in shape.

Included with this soil in mapping are small areas of the moderately well drained Eel soils. Also included are small, long areas of Shoals or Sloan soils in drainageways or old stream channels. Spots of the more sandy Landes soils are included in some areas next to rivers.

Flooding is the major limitation for farming. Streambank erosion is also a hazard in some areas. Flooding is most common in winter and spring but can occur in all seasons. It is the dominant limitation for most nonfarm uses.

Most areas are used for cultivated crops, to which they are well suited if protected from flooding. The soil has severe limitations for most recreational and urban developments. Capability unit IIw-1; woodland suitability 1o.

Gilford Series

The Gilford series consists of nearly level, very poorly drained soils that formed in sandy material. These soils occupy depressional areas throughout the county.

In a representative profile the surface layer is a very dark grayish brown fine sandy loam 11 inches thick. The mottled subsoil, from 11 to 39 inches, is grayish brown sandy loam. The substratum, from 39 to 49 inches, is light brownish gray loamy coarse sand and to a depth of 60 inches is mottled, dark grayish brown silty clay loam.

Gilford soils have a deep root zone and moderate available water capacity. Permeability is moderately rapid. These soils are saturated for significant periods in winter and spring and dry slowly unless adequately drained.

Gilford soils are well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Gilford fine sandy loam, in a cultivated field SW¼SE¼NE¼NE¼ sec. 10, Pulaski Township; T. 6 N., R. 3 E., 102 feet north of field boundary in east-west line with big tree, 240 feet west of County Road 17:

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam; moderate medium subangular blocky structure parting to weak medium granular; friable; many fine roots; light colored sand grains coating faces of peds; slightly acid; abrupt smooth boundary.

B1g—11 to 16 inches; grayish brown (10YR 5/2) fine sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse and medium angular blocky structure; friable; common fine roots; dark gray (10YR 4/1) coatings on faces of peds; few dark concretions; 1 percent fine gravel; very dark grayish brown (10YR 3/2) fillings in old root channels; neutral; clear smooth boundary.

B21g—16 to 26 inches; grayish brown (2.5Y 5/2) sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse and medium angular blocky structure; friable; few fine roots; dark gray (10YR 4/1) coatings on faces of peds; organic stain on faces of some peds; 5 to 10 percent gravel; few pockets of loamy sand; mildly alkaline; abrupt wavy boundary.

B22g—26 to 39 inches; grayish brown (10YR 5/2) coarse sandy loam; common medium distinct dark yellowish brown (10YR 4/4) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse and medium angular blocky structure; friable; few fine roots; dark gray (10YR 4/1) coatings on faces of peds; organic stain on faces of some peds; 5 to 10 percent gravel; few pockets of loamy sand; mildly alkaline; abrupt wavy boundary.

IIC1—39 to 49 inches; light brownish gray (10YR 6/2) loamy coarse sand; single grained; loose; 10 percent gravel; calcareous; moderately alkaline; abrupt smooth boundary.

IIIC2—49 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct gray (10YR 5/1) mottles; weak thick platy structure; firm; dark gray (10YR 4/1) coatings on faces of peds; calcareous; moderately alkaline.

The thickness of the solum ranges from 26 to 44 inches. The depth to carbonates ranges from 30 to 42 inches. The gravel content in the solum ranges from 0 to 10 percent.

The A horizon is 10 to 14 inches thick and is 10YR hue, value 2 or 3, and chroma of 1 or 2. Reaction is commonly slightly acid unless the soil is limed.

The B horizon is 10YR to 2.5Y hue, value of 4 through 6, and chroma of 1 or 2. The texture is fine sandy loam to coarse sandy loam with subhorizons of loamy sand to sandy clay loam. Reaction ranges from slightly acid to mildly alkaline.

The IIC horizon is coarse textured and is 10YR to 2.5Y hue, value of 4 through 6, and chroma of 0 through 6. Reaction ranges from mildly alkaline to moderately alkaline. This horizon is commonly calcareous. A IIIC horizon occurs in most pedons and is silty clay loam to clay.

Gilford soils are the very poorly drained members of a drainage sequence that includes the well drained Boyer and Oshtemo soils. They are similar to Millgrove soils but have less clay and more sand in the subsoil. In contrast with Colwood soils, Gilford soils

have less clay and are not stratified with fine sands and silts. They are similar to Lamson soils but contain more medium and coarse sand and have a slightly thicker, dark surface layer.

Gf—Gilford fine sandy loam. This nearly level soil is on broad upland areas on the lake plain and some stream terraces. It is easily tilled and has good structure and tilth.

Included with this soil in mapping are small areas of the somewhat poorly drained Digby soils. Also included, near the edge of this soil, are small areas of Millgrove and Mermill soils.

Seasonal wetness with a hazard of ponding is the major limitation for farming. The soil drains readily when artificial drainage is installed. The seasonal high water table is a limitation for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is well suited to farming if the excess water is removed. It has severe limitations for recreational and urban developments. Capability unit IIw-9; woodland suitability 4w.

Glynwood Series

The Glynwood series consists of moderately well drained, gently sloping to steep soils on uplands. These soils formed in moderately fine textured glacial till. They occur on sides of ridges and in areas adjacent to drainageways.

In a representative profile the surface layer is dark grayish brown loam 8 inches thick. The subsoil, from 8 to 32 inches, is dark yellowish brown and brown clay loam that is mottled with gray colors and is very firm below 15 inches. The substratum to a depth of 60 inches is mottled, brown clay loam glacial till.

Glynwood soils have a moderately deep root zone and a moderate available water capacity. Permeability is slow in the subsoil and substratum. Artificial drainage is generally not needed, except in spots where runoff concentrates.

Glynwood soils are well suited to farming on the gently sloping and sloping areas. They are well suited to openland wildlife. Limitations for most nonfarm uses are moderate or severe. These soils are generally well suited to woodland.

Most areas have been cleared and are used for pasture and cultivated crops. Some areas are wooded.

Representative profile of Glynwood loam, 2 to 6 percent slopes, in a cultivated field SW¼SW¼ sec. 28, Center Township; T. 6 N., R. 2 E., 75 feet east of County Road 9 and 0.26 mile north of U.S. Route 6:

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

B1—8 to 11 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; 2 to 4 percent glacial pebbles; strongly acid; clear wavy boundary.

B21t—11 to 15 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium prismatic structure parting to moderate medium angular blocky; firm; 2 to 4 percent glacial pebbles; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—15 to 22 inches; brown (10YR 4/3) clay loam; common fine faint dark grayish brown (10YR 4/2) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; very firm; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 2 to 4 percent glacial pebbles; neutral; clear wavy boundary.

B3t—22 to 32 inches; dark yellowish brown 10YR 4/4) clay loam; common fine faint grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; very firm; thin continuous dark grayish brown (2.5Y 4/2) clay films on faces of peds; few small light brownish gray (10YR 6/2) lime concretions; calcareous; moderately alkaline.

C—32 to 60 inches; brown (10YR 4/3) clay loam; few fine faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) mottles; weak medium platy structure; firm; calcareous; moderately alkaline.

The depth to carbonates ranges from 20 to 38 inches. The thickness of the solum ranges from 22 to 40 inches.

The A horizon is generally 4 to 11 inches thick, but in some pedons it has been mostly removed by erosion. The Ap horizon is dark grayish brown or brown in 10YR hue, value of 4, and chroma of 2 or 3. Undisturbed areas have an A1 horizon with value of 2 or 3 and chroma of 1 or 2. The A horizon is mostly loam but ranges to clay loam. Reaction ranges from medium acid to neutral. An A2 or B&A horizon occurs in some pedons.

The B horizon is 10YR hue, value of 4 or 5, and chroma of 3 or 4. The texture is heavy clay loam or clay. Reaction ranges from strongly acid to slightly acid in the upper part and slightly acid to moderately alkaline and calcareous in the lower part.

The C horizon is clay loam glacial till. It is 10YR hue, value of 4 or 5, and chroma of 3 or 4. It is mottled. The reaction is moderately alkaline. This horizon is calcareous.

Glynwood soils are the moderately well drained members of a drainage sequence that includes the very poorly drained Pewamo soils and the somewhat poorly drained Blount soils. Glynwood soils are similar to Shinrock, Lucas, and St. Clair soils. In contrast with Shinrock and Lucas soils, they have glacial pebbles and are not stratified. They differ from St. Clair soils in having less clay just below the plow layer.

GlB—Glynwood loam, 2 to 6 percent slopes. This gently sloping soil occurs as long strips on slope breaks along small drainageways. Most slopes are short to moderate. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of the wetter Blount soils, which are generally on the

more level areas and lower parts of slopes. Also included, in some areas, are spots of Rawson, Haskins, and Seward soils. The sand spot symbol is commonly used to identify the more sandy soils on the soil map. Areas on the Wabash Moraine have a loam instead of a clay loam substratum. These loamy layers are slightly more pervious.

A moderate erosion hazard is the major limitation for farming. Slow permeability and slope are limitations for some nonfarm uses.

Most areas are used for crops. Some are wooded. This soil is well suited to farming if erosion is controlled. It has a moderate to severe limitation for most recreational and urban developments. Capability unit IIe–2; woodland suitability 2o.

GlB2—Glynwood loam, 2 to 6 percent slopes, moderately eroded. This soil occurs as long strips on slope breaks along small drainageways and on low ridges throughout the morainic areas of the county. Most slopes are short to moderately long. About 60 to 70 percent of most areas is moderately eroded. The profile is similar to the one described as representative of the series, but that the surface layer is thinner and has been mixed by plowing with finer textured subsoil material. The surface layer is also lower in organic matter content and has poorer tilth.

Included with this soil in mapping are small, severely eroded areas. Spots of Rawson and Seward soils are common in some areas of the county. Also included are small areas of Blount and Haskins soils on the lower slopes and more level spots. Areas of Glynwood soils that occur on the Wabash Moraine have a loamy and more pervious substratum texture.

A severe erosion hazard is the major limitation for farming. Slow permeability and slope are limitations for some nonfarm uses.

Most areas are used for crops. Some are in pasture. This soil is suited to farming if protected from erosion. It has moderate to severe limitations for most recreational and urban developments. Capability unit IIIe–2; woodland suitability 2o.

GlC—Glynwood loam, 6 to 12 percent slopes. This sloping soil occurs on narrow and long slope breaks along drainageways and on side slopes of morainic ridges. Most of the slopes are moderately long to short. The profile is similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are small areas of Seward soils. Areas of this soil on the Wabash Moraine have a more loamy and pervious substratum.

Slope and a severe erosion hazard are the major limitations for farming. Surface runoff is rapid. Slow permeability and slope are limitations for many nonfarm uses.

Most areas are used for crops. A few are wooded. This soil is suited to farming if protected from erosion. It has moderate to severe limitations for most recreational and urban developments. Capability unit IIIe–2; woodland suitability 2o.

GlC2—Glynwood loam, 6 to 12 percent slopes, moderately eroded. This sloping soil occurs on narrow and long slope breaks along drainageways and on side slopes of morainic ridges. Most slopes are short to moderately long. In most areas about 80 percent or more is moderately eroded. The profile is similar to the one described as representative of the series, but the present surface layer is a mixture of the original surface layer and the finer textured subsoil material. Lower organic-matter content and poorer tilth of the surface layer are the effects of past erosion.

Included with this soil in mapping are spots on the steeper areas that are severely eroded. Spots of Rawson and Seward soils are common in some areas of the county. Areas of the Wabash Moraine have a slightly more pervious loamy substratum texture.

Slope and a severe erosion hazard are the major limitations for farming. Slow permeability and slope are limitations for many nonfarm uses.

Most areas are used for crops. Some are in pasture. This soil is suited to farming if protected from erosion. It has moderate to severe limitations for most recreational and urban developments. Capability unit IIIe–2; woodland suitability 2o.

GlD2—Glynwood loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil occupies narrow slope breaks adjacent to major drainageways. It is less common on side slopes or morainic ridges. Most slopes are short. About 50 to 60 percent of most areas is moderately eroded.

Included with this soil in mapping are a few severely eroded areas with a clay loam surface layer and poor tilth. Also included are a few areas on the Wabash Moraine with loamy textures in the substratum. These layers are more pervious than corresponding layers in the regular Glynwood soils.

Slope and a severe erosion hazard are the major limitations for farming. Surface runoff is rapid. Slow permeability and slope are limitations for many nonfarm uses.

About half the areas are used for pasture and meadow. Some are used for row crops. Many areas are wooded. This soil is suited to farming if protected from erosion. It has severe limitations for most recreational and urban developments. Capability unit IVe–1; woodland suitability 2r.

GlE2—Glynwood loam, 18 to 40 percent slopes, moderately eroded. This steep soil occupies slope breaks along the larger drainageways. The slopes are short to moderate. About 50 to 75 percent of most areas is moderately eroded. Most areas are uncultivated, but overgrazing has caused erosion in the past. The profile has a thinner surface layer than the one described as representative of the series.

Included with this soil in mapping are a few severely eroded areas where the surface layer is clay loam and has poor tilth. These are commonly on the steeper areas that are used for pasture. Also included in mapping are a few areas of soils on the Wabash Moraine with a loamy substratum.

A very severe erosion hazard and steep slopes are the major limitations for any use requiring tillage. Runoff is rapid. Steep slope is the dominant limitation for most nonfarm uses.

Most areas are used for pasture. Some are wooded. This soil is well suited to woodland. It has severe limitations for recreational and urban developments. Capability unit VIIe–1; woodland suitability 2r.

Haney Series

The Haney series consists of moderately well drained, nearly level to sloping soils on beach ridges, outwash plains, and stream terraces throughout the county. These soils formed in water laid deposits of loamy material over gravelly and sandy material.

In a representative profile the surface layer is a dark grayish brown loam 9 inches thick. The subsurface layer, from 9 to 13 inches, is pale brown sandy loam. The subsoil, from 13 to 29 inches, is mottled, brown and dark yellowish brown loam and sandy clay loam and, from 29 to 34 inches, brown gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown and grayish brown stratified sand and gravel.

Haney soils have a deep root zone and a moderate available water capacity. Permeability is moderate in the surface layer and subsoil and rapid in the underlying sand and gravel.

These soils are well suited to farming, openland wildlife, and woodland. Most areas are used for cultivated crops. A few are wooded.

Representative profile of Haney loam, 1 to 6 percent slopes, in a cultivated field SE¼SE¼SW¼NE¼ sec. 19, Superior Township; 300 feet east of house, 500 feet south of east-west fence:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure parting to moderate fine and medium granular; friable; many fine roots; 2 percent coarse fragments; neutral; abrupt smooth boundary.

A2—9 to 13 inches; pale brown (10YR 6/3) sandy loam; weak fine and medium subangular blocky structure; friable; common fine roots; few dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) worm and root channels; 2 percent coarse fragments; slightly acid; clear wavy boundary.

B1t—13 to 18 inches; dark yellowish brown (10YR 4/4) heavy loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate coarse angular blocky structure parting to moderate medium subangular blocky; firm; common fine roots; thin patchy brown (10YR 4/3) clay films on faces of peds; few very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) worm and root channels; 2 to 4 percent coarse fragments; slightly acid; gradual wavy boundary.

B2t—18 to 29 inches; brown (10YR 4/3) heavy sandy clay loam; common medium distinct strong brown (7.5YR 5/6) and common medium faint dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; 5 to 10 percent coarse fragments; slightly acid; gradual wavy boundary.

IIB3t—29 to 34 inches; brown (10YR 4/3) gravelly sandy loam; few medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; dark grayish brown (10YR 4/2) clay bridging of sand grains; 15 to 25 percent coarse fragments; mildly alkaline; clear wavy boundary.

IIC—34 to 60 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) stratified sand and gravel and thin layers of sandy loam; single grained; loose; calcareous; moderately alkaline.

The depth to carbonates ranges from 30 to 44 inches. The thickness of the solum ranges from 28 to 40 inches. Gravel content ranges from 2 to 15 percent in the upper part of the solum and from 10 to 35 percent in the lower part.

The Ap horizon is generally 7 to 10 inches thick. It is 10YR hue, value of 4 or 5, and chroma of 2 or 3. The texture is sandy loam or loam. Reaction ranges from medium acid to neutral.

The B and IIB horizons are 7.5YR or 10YR hue, value of 3 through 5, and chroma of 3 or 4. The texture is dominantly sandy clay loam or clay loam but ranges to heavy loam and sandy loam and includes gravelly analogs of those textures. Reaction ranges from medium acid to slightly acid in the upper part and slightly acid to mildly alkaline in the lower part.

The C horizon is 10YR hue, value of 4 through 6, and chroma of 2 through 4. It is sand and gravel and thin strata of finer material. Reaction is mildly or moderately alkaline. This horizon is calcareous.

Haney soils are the moderately well drained members of the drainage sequence that includes the well drained Belmore soils, the somewhat poorly drained Digby soils, and the very poorly drained Millgrove soils. Haney soils are similar to Rawson soils in the upper part of the profile but are much coarser textured in the lower part of the subsoil and in the substratum. They have a more clayey subsoil than the nearby Oshtemo and Boyer soils and are not so well drained.

HaB—Haney loam, 1 to 6 percent slopes. This nearly level to gently sloping soil is on beach ridges, stream terraces, and outwash plains. It occurs mainly as long strips. Some areas on outwash plains are broad. This soil has the profile described as representative of the series.

Included with this soil in mapping are narrow areas of the darker and wetter Millgrove soils along drainageways and small areas of Rawson soils where this soil borders finer textured soils. Also included are areas of the well drained Oshtemo and Belmore soils on beach ridges and small areas of the well drained Boyer and Oshtemo soils on stream terraces along the St. Joseph River.

A moderate erosion hazard is the major limitation for farming. Slope is a limitation for some nonfarm uses.

Most areas are used for crops. Some are wooded. This soil is well suited to farming if protected from erosion. It has slight to moderate limitations for most recreational and urban developments. Capability unit IIe-1; woodland suitability 2o.

HeB—Haney-Rawson sandy loams, 1 to 6 percent slopes. This nearly level to gently sloping map unit occurs as long strips and low knolls on glacial outwash areas of the Wabash Moraine in the northwestern part of the county. It is 40 to 60 percent Haney soils, 20 to 40 percent Rawson soils, and 5 to 15 percent Morley or Shinrock and other more clayey soils.

Included with this unit in mapping are spots of the more sandy Spinks or Ottokee soils and narrow areas of the wetter Millgrove and Mermill soils along drainageways.

A moderate erosion hazard is the major limitation for farming. Slope is a limitation for some nonfarm uses.

Most areas are used for crops. Some areas are wooded. This unit is well suited to farming if protected from erosion. It has slight to moderate limitations for most recreational and urban developments. Capability unit IIe-1; woodland suitability 2o.

HeC—Haney-Rawson sandy loams, 6 to 12 percent slopes. This sloping map unit occupies long strips on glacial outwash areas of the Wabash Moraine in the northwestern part of the county. It is 40 to 70 percent Haney soils, 20 to 40 percent Rawson soils, and 5 to 15 percent Glynwood or Shinrock and other more clayey soils. Slopes are commonly short and choppy.

Included with this unit in mapping are spots of the more sandy Spinks or Ottokee soils and small areas of the Tuscola variant. Some narrow drainageways consist of the wetter Millgrove or Mermill soils.

A severe erosion hazard is the major limitation to farming. Slope is a limitation for many nonfarm uses.

Most areas are used for crops and pasture. Some are wooded. This unit is moderately well suited to farming if protected from erosion. It has moderate to severe limitations for most recreational and urban developments. Capability unit IIIe-1; woodland suitability 2o.

Haskins Series

The Haskins series consists of nearly level, somewhat poorly drained soils. These soils formed in medium textured outwash materials and the underlying lacustrine clay or till. They occur throughout the county.

In a representative profile the surface layer is dark grayish brown sandy loam 8 inches thick. The subsurface layer, about 5 inches thick, is light brownish gray, mottled sandy loam. The subsoil from 13 to 26 inches is mottled, light brownish gray and dark yellowish brown sandy loam and sandy clay loam and from 26 to 37 inches is mottled, brown silty clay. The substratum is brown and dark yellowish brown silty clay.

Haskins soils have a moderately deep root zone and a moderate available water capacity. Permeability is moderate in the surface layer and upper part of the subsoil and slow or very slow in the lower part of the subsoil and in the substratum. These soils are saturated for significant periods in winter and spring and dry slowly unless adequately drained.

Haskins soils are well suited to farming if the excess water is removed. They are well suited to openland wildlife. Limitations for most nonfarm uses are moderate to severe.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Haskins sandy loam, 0 to 3 percent slopes, in a cultivated field SW¼NE¼SE¼SW¼ sec. 32, Pulaski Township; T. 6 N., R. 3 E., 55 feet west of field boundary:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam; weak fine granular structure; friable; many fine roots; few pebbles; neutral; abrupt smooth boundary.

A2—8 to 13 inches; light brownish gray (10YR 6/2) sandy loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure parting to moderate fine angular blocky; friable; common fine roots; common fine distinct brown (7.5YR 4/4) stains; dark gray (10YR 4/1) organic stains in root channels; few pebbles; neutral; abrupt wavy boundary.

B21t—13 to 26 inches; dark yellowish brown (10YR 4/4) light sandy clay loam; many fine distinct grayish brown (10YR 5/2) and few fine distinct pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; few fine roots; medium distinct very dark brown (10YR 2/2) stains; few pebbles; few pockets of gravelly sandy clay loam; thin patchy grayish brown (10YR 5/2) clay films on vertical faces of peds and bridging sand grains; mildly alkaline; abrupt wavy boundary.

B22t—26 to 31 inches; brown (10YR 4/3) silty clay; many fine distinct gray (5Y 5/1) and few fine distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate fine and medium angular blocky; firm; few fine roots; thin patchy grayish brown (2.5Y 5/2) clay films on faces of peds; mildly alkaline; abrupt smooth boundary.

B3—31 to 37 inches; brown (10YR 4/3) silty clay; common fine distinct gray (5Y 5/1) and common medium distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate medium and fine angular blocky; very firm; few fine roots; thin patchy gray (5Y 5/1) clay films on vertical faces of peds; common fine light gray (10YR 7/1) lime segregations; calcareous; mildly alkaline; abrupt wavy boundary.

C1—37 to 43 inches; brown (10YR 4/3) silty clay; common fine distinct grayish brown (10YR 5/2) and gray (5Y 5/1) mottles; massive; some vertical cleavages; very firm; gray (5Y 5/1) cleavage

faces; calcareous; moderately alkaline; abrupt smooth boundary.

C2—43 to 46 inches; pale brown (10YR 6/3) heavy silty clay loam; common fine distinct gray (10YR 5/1) and dark yellowish brown (10YR 4/4) mottles; massive; some vertical cleavages; firm; gray (5Y 5/1) cleavage faces; light gray (10YR 7/1) lime segregations; calcareous; moderately alkaline; abrupt smooth boundary.

IIC3—46 to 63 inches; dark yellowish brown (10YR 4/4) silty clay; common fine distinct gray (10YR 5/1) mottles; massive; very firm; calcareous; moderately alkaline.

The depth to carbonates ranges from 28 to 40 inches. The thickness of the solum ranges from 24 to 45 inches. The gravel content of the solum ranges from 2 to 20 percent in the upper part and from 0 to 8 percent in the lower part.

The Ap horizon is 6 to 9 inches thick and is 10YR hue, value of 4 or 5, and chroma of 1 or 2. The texture is loam or sandy loam. Reaction ranges from medium acid to neutral.

The B horizon is 10YR or 2.5Y hue, value of 4 or 5, and chroma of 2 through 4. The texture ranges from sandy loam to clay loam with gravelly phases. Reaction ranges from medium acid to mildly alkaline.

The B horizon is 10YR or 2.5Y hue, value of 4 or 5, and chroma of 0 through 3. The texture includes clay, silty clay, heavy clay loam, and heavy silty clay loam. Reaction ranges from neutral to mildly alkaline. In places this horizon is calcareous in the lower part.

The C horizon is 10YR to 5Y hue, value of 4 through 6, and chroma of 1 through 3. The texture includes clay, silty clay, heavy clay loam, and heavy silty clay loam.

Haskins soils are somewhat poorly drained members of a drainage sequence, which includes the moderately well drained Rawson soils and the very poorly drained Mermill soils. The Haskins soils resemble the Digby soils in the upper part of the profile. In contrast, they do not have a sand and gravel substratum. They are similar to Rimer soils but are less sandy in the upper part of the profile.

HkA—Haskins sandy loam, 0 to 3 percent slopes. This nearly level soil occurs as long strips, in small somewhat oval areas, and on broad flats. It has the profile described as representative of the series. This soil is very friable and is easy to keep in good tilth.

Included with this soil in mapping are small areas of Digby soils and narrow strips of the wetter Mermill soils. A few spots of more sandy soils are included in some areas.

Seasonal wetness is the major limitation for farming. Wet spots are more common along the edge of Haskins soils where they adjoin clayey soils. Soil erosion is a minor hazard on the more sloping areas. Seasonal wetness is also a limitation for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is well suited to farming if the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw-3; woodland suitability 2w.

HnA—Haskins loam, 0 to 3 percent slopes. This nearly level soil occupies long strips, relatively small oval areas, and moderately broad flats. The profile is not so sandy in the upper part as the one described as representative of the series. It has a slightly higher available water capacity and is less droughty than Haskins sandy loam soil. It also has a lower rate of infiltration and greater runoff.

Included with this soil in mapping are narrow strips of the wetter Mermill soils in drainageways and depressions and small areas of Digby soil. Also included are small areas of soils, east of Pulaski, that formed in stratified silt and fine sand over clay loam till.

Seasonal wetness is the major limitation for farming and for many nonfarm uses. Soil erosion is a minor hazard on the more sloping areas.

Most areas have been cleared and are used for cultivated crops. This soil is well suited to farming if the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw-3; woodland suitability 2w.

Hoytville Series

The Hoytville series consists of nearly level, very poorly drained, clayey soils. These soils formed in fine textured glacial till on lake plains where the glacial till has been leveled and reworked by lake action.

In a representative profile the surface layer is very dark gray clay 8 inches thick. The subsoil, from 8 to 50 inches, is mottled gray clay. The substratum to a depth of 60 inches is yellowish brown clay.

Hoytville soils have a deep root zone when drained and a high available water capacity. Permeability is moderately slow in the subsoil and slow in the substratum. These soils are saturated for significant periods in winter and spring and dry slowly unless adequately drained. Surface runoff is slow, and ponding is common.

Hoytville soils are well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Hoytville clay in a plowed field NW¼NE¼NE¼NE¼ sec. 34, Jefferson Township; T. 7 N., R. 3 E., 0.4 mile east of U.S. Route 127:

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay; weak fine angular blocky structure parting to moderate fine granular; friable; many fine roots; 2 percent pebbles; neutral; abrupt smooth boundary

B21tg—8 to 12 inches; gray (5Y 5/1) clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak fine angular blocky structure; firm; many fine roots; thin patchy clay films on vertical faces of peds; 3 percent pebbles; neutral; clear smooth boundary.

B22tg—12 to 22 inches; gray (5Y 5/1) clay; common distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate me-

dium angular blocky; firm; common fine roots; thin patchy clay films on faces of peds; 2 to 3 percent pebbles; mildly alkaline; gradual smooth boundary.

B23tg—22 to 29 inches; gray (5Y 5/1) clay; common fine distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; common fine roots; thin patchy clay films on faces of peds; 3 percent pebbles; mildly alkaline; gradual smooth boundary.

B24tg—29 to 43 inches; gray (5Y 5/1) clay; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; thin patchy clay films on faces of peds; 3 to 4 percent pebbles; moderately alkaline; clear wavy boundary.

B3tg—43 to 50 inches; gray (5Y 5/1) clay; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few fine roots; thin very patchy clay films on vertical faces of peds; 2 percent pebbles; calcareous; moderately alkaline; gradual wavy boundary.

C—50 to 60 inches; yellowish brown (10YR 5/4) clay; massive; some vertical cleavages; very firm; gray (5Y 5/1) coatings on cleavage faces; 2 percent pebbles; calcareous; moderately alkaline.

The depth to carbonates ranges from 30 to 50 inches. The thickness of the solum ranges from 36 to 55 inches. The soil is 2 to 8 percent coarse fragments, dominantly limestone and shale and some igneous pebbles.

The Ap horizon is commonly 6 to 9 inches thick and is 10YR hue, value of 2 or 3, and chroma of 1 or 2. Reaction ranges from slightly acid to neutral.

The B horizon is 10YR to 5Y hue, value of 4 through 6, and chroma of 1 or 2, and it is mottled. The texture is clay or silty clay, but thin layers of silty clay loam or clay loam are present in some pedons. Reaction ranges from neutral to mildly alkaline in the upper part and from neutral to moderately alkaline and calcareous in the lower part.

The C horizon is 10YR to 5Y hue, value of 4 or 5, and chroma of 1 through 4. The texture is clay or clay loam.

Hoytville soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Nappanee soils and the moderately well drained St. Clair soils. They formed in glacial till instead of lacustrine sediments, as did the Latty, Paulding, and Toledo soils. They are also less clayey than are the Paulding soils. They are similar to Pewamo soils that occur on the till plain but have a slightly thinner, dark surface layer.

Hv—Hoytville clay. This nearly level soil occurs as long strips or as broad flats on the lake plain. It becomes cloddy if worked when too wet, and crusting commonly follows rains.

Included with this soil in mapping are small areas of Nappanee soil on low rises and narrow strips of Mermill soils. Near Bryan, areas that have a silty or sandy substratum below a thin layer of glacial till are also included.

Seasonal wetness is the major limitation for farming. Ponding occurs in depressional areas. Seasonal wetness and slow permeability are limitations for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is well suited to farming if the excess water is removed. It has severe limitations for most recreational and urban developments. Capability unit IIw-7; woodland suitability 3w.

Kibbie Series

The Kibbie series consists of nearly level and gently sloping, somewhat poorly drained soils on the lake plain. These soils formed in silty or loamy materials and are underlain by stratified silts, fine sands, and very fine sands.

In a representative profile the surface layer is dark grayish brown very fine sandy loam 10 inches thick. The subsoil, from 10 to 42 inches, is mottled, yellowish brown and grayish brown very fine sandy loam and silt loam. The substratum to a depth of 60 inches is light olive brown silt loam and very fine sandy loam.

Kibbie soils have a deep root zone and a high available water capacity. Permeability is generally moderate throughout, but some variability occurs because of stratification in the substratum. The soils have a seasonal high water table for long periods in winter and spring and dry slowly unless adequately drained.

Kibbie soils are well suited to farming if the excess water is removed. They are well suited to openland wildlife. Limitations for most nonfarm uses are moderate to severe.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Kibbie very fine sandy loam, 0 to 2 percent slopes, in a cultivated field SW¼SE¼SE¼SW¼ sec. 28, Brady Township; T. 7 N., R. 4 E., 100 feet north of County Road H, 150 feet south of woods:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) very fine sandy loam; weak medium granular structure; friable; many fine roots; very dark grayish brown (10YR 3/2) coatings on faces of peds; 3 percent coarse fragments; slightly acid; abrupt smooth boundary.

B1t—10 to 13 inches; yellowish brown (10YR 5/4) very fine sandy loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate fine and medium subangular blocky structure; friable; many fine roots; dark grayish brown (10YR 4/2) organic coatings on faces of peds; thin very patchy yellowish brown (10YR 5/4) clay films in pores; 2 percent coarse fragments; neutral; gradual wavy boundary.

B21tg—13 to 20 inches; yellowish brown (10YR 5/4) silt loam; many fine distinct gray-

ish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin patchy dark grayish brown (10YR 4/2) clay films on vertical and horizontal faces of peds; 2 percent coarse fragments; few fine dark brown (10YR 3/3) concretions; neutral; gradual wavy boundary.

B22tg—20 to 26 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; friable; common fine roots; medium patchy grayish brown (10YR 5/2) clay films on faces of peds; 1 percent coarse fragments; few medium very dark brown (10YR 2/2) concretions; mildly alkaline; gradual wavy boundary.

B31tg—26 to 34 inches; grayish brown (2.5Y 5/2) silt loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; friable; few fine roots; thin very patchy grayish brown (10YR 5/2) clay films on faces of peds; light brownish gray (2.5Y 6/2) silt coatings on faces of prisms; few medium very dark brown (10YR 2/2) concretions; 1 percent coarse fragments; mildly alkaline; gradual wavy boundary.

B32—34 to 42 inches; yellowish brown (10YR 5/4) silt loam; many coarse distinct light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; friable; few fine roots; light brownish gray (2.5Y 6/2) silt coatings on faces of prisms; calcareous; moderately alkaline; abrupt smooth boundary.

C—42 to 60 inches; light olive brown (2.5Y 5/4) silt loam and very fine sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak thin platy structure, with some vertical cleavage breaks; friable; grayish brown (2.5Y 5/2) silt coatings on cleavage faces; calcareous; moderately alkaline.

The depth to carbonates ranges from 24 to 45 inches. The thickness of the solum is 28 to 48 inches.

The Ap horizon is commonly 7 to 10 inches thick and is 10YR hue, value of 4, and chroma of 2 or 3. Reaction is slightly acid or neutral.

The B horizon is 10YR hue, value of 4 or 5, chroma of 2 through 4 and is mottled. The texture includes silt loam, loam, clay loam, and silty clay loam. Reaction is commonly medium acid to mildly alkaline but ranges to moderately alkaline in the lower part. In places this horizon is calcareous.

The C horizon is 10YR or 2.5Y hue, value of 4 through 6, and chroma of 2 through 4. The texture is variable as a result of stratification and ranges from fine sand to silt loam. Thin strata of clay loam or silty clay occur in some pedons. Reaction is moderately alkaline. This horizon is calcareous.

Kibbie soils are the somewhat poorly drained members of a drainage sequence that includes the very poorly drained Colwood and the moderately well drained Tuscola variant soils. Kibbie soils are similar to Digby soils but contain less sand and gravel.

The Kibbie soils in the survey area have a lighter colored surface layer than Kibbie soils mapped elsewhere, but this difference does not affect their use and management.

KlA—Kibbie very fine sandy loam, 0 to 2 percent slopes. This nearly level soil is on the lake plain. It occupies long low ridges near drainageways, small oval areas, and moderately broad flats. The profile is the one described as representative of the series. The soil is friable, and surface runoff is slow. This soil crusts after a hard rain.

Included with this soil in mapping are small areas of the wetter Colwood soils, which occur as narrow strips along drainageways and in low spots. Also included are a few areas southeast of West Unity that have less clay in the subsoil. Some areas contain spots of the more sandy Rimer soils.

Seasonal wetness is the major limitation for farming and for many nonfarm uses. Soil blowing is a hazard. A high potential frost action is also a limitation.

Most areas are used for crops. This soil is well suited to farming if the excess water is removed. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw-3; woodland suitability 2w.

KlB—Kibbie very fine sandy loam, 2 to 6 percent slopes. This gently sloping soil is on the lake plain. It occurs as long, narrow to moderately wide strips adjacent to drainageways and on low rises. This soil has a slightly thinner profile and has had more erosion than the one described as representative of the series. This soil is friable and easy to keep in good tilth, but it crusts after heavy rains.

Included with this soil in mapping are small areas of the finer textured Del Rey soils. Also included are a few areas southeast of West Unity that have less clay in the subsoil and areas of the wetter Colwood soils along drainageways and in depressions.

Seasonal wetness and the hazard of erosion are the major limitations for farming. Erosion control is needed. Seasonal wetness is the main limitation for many nonfarm uses. The high frost action potential is also a limitation.

Most areas are used for crops. This soil is well suited to farming if the excess water is removed and erosion is controlled. It has moderate to severe limitations for recreational and urban developments. Capability unit IIw-3; woodland suitability 2w.

Lamson Series

The Lamson series consists of nearly level, very poorly drained soils on depressional areas of the lake plain. These soils formed in stratified materials of silt loam to very fine sand.

In a representative profile the surface layer is very dark gray very fine sandy loam 9 inches thick. The subsurface layer is mottled, gray very fine sandy loam about 4 inches thick. The subsoil, from 13 to 32 inches,

is mottled, gray loam, very fine sandy loam, and loamy very fine sand. The substratum to a depth of 60 inches is gray silt loam.

Lamson soils have a deep root zone if artificially drained. The available water capacity and permeability are moderate. These soils have a seasonal high water table and are saturated for significant periods. Some ponding occurs during heavy rains, but this ponded water infiltrates the soil quickly. There is very little surface runoff.

Lamson soils are well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Lamson very fine sandy loam in a cultivated field NW¼SE¼NW¼NW¼ sec. 15, Brady Township; T. 7 N., R. 4 E., 187 feet east of north-south fence and 450 feet south of east-west fence:

Ap—0 to 6 inches; very dark gray (10YR 3/1) very fine sandy loam; moderate medium granular structure; very friable; many fine roots; black (10YR 2/1) coatings on faces of peds; neutral; abrupt smooth boundary.

A12—6 to 9 inches; very dark gray (10YR 3/1) very fine sandy loam; weak medium subangular blocky structure; friable; many fine roots; black (10YR 2/1) coatings on faces of peds; neutral; abrupt smooth boundary.

A2g—9 to 13 inches; gray (N 5/0) very fine sandy loam; many fine faint dark gray (10YR 4/1) and common fine prominent dark reddish brown (5YR 3/3) mottles; weak medium subangular blocky structure; friable; many fine roots; patchy black (10YR 2/1) coatings on faces of peds; numerous root, earthworm, and crayfish channels filled with black (10YR 2/1) very fine sandy loam; neutral; clear smooth boundary.

B21g—13 to 18 inches; gray (N 5/0) loam; common medium distinct very dark gray (10YR 3/1) and many fine and medium prominent dark reddish brown (5YR 3/4) mottles; weak medium angular blocky structure; friable; common fine roots; patchy black (10YR 2/1) coatings on faces of peds; numerous root, earthworm, and crayfish channels filled with black (10YR 2/1) very fine sandy loam; mildly alkaline; clear smooth boundary.

B22g—18 to 24 inches; gray (N 5/0) very fine sandy loam; many medium distinct yellowish brown (10YR 5/6) and common fine distinct dark brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; friable; common fine roots; patchy very dark gray (10YR 3/1) coatings on faces of peds; numerous root, earthworm, and crayfish channels filled with black (10YR 2/1) loam and very fine sandy loam; less than 1 percent small pebbles; mildly alkaline; clear wavy boundary.

B3g—24 to 32 inches; gray (N 5/0) loamy very fine sand; common medium distinct light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6) mottles; massive; friable; few fine roots; few old root channels with very dark gray (10YR 3/1) coatings; less than 1 percent small pebbles; calcareous; moderately alkaline; clear wavy boundary.

C—32 to 60 inches; gray (N 5/0) silt loam; massive; friable; many dark stains coating old root channels; calcareous; mildly alkaline.

The thickness of the solum ranges from 30 to 45 inches.

The Ap horizon is generally 6 to 9 inches thick and is 10YR hue, value of 2 or 3, and chroma of 1. Reaction ranges from slightly acid to neutral.

The B horizon is 10YR or 2.5Y hue or neutral, value of 4 through 6, and chroma of 0 through 2, and it is mottled. The texture is loamy very fine sand, very fine sandy loam, and loam. Reaction ranges from neutral to moderately alkaline. In places this horizon is calcareous in the lower part.

The C horizon is 2.5Y hue or neutral, value of 4 through 6, and chroma of 0 or 1. The texture is loamy very fine sand, silt loam, and very fine sand.

Lamson soils are the very poorly drained members of a drainage sequence that includes the well drained Arkport soils. Lamson soils are similar to Colwood soils but have a thinner and lighter colored surface layer and a lower clay content. They are similar to Gilford soils but contain less medium and coarse sand and have a slightly thinner, dark surface layer.

La—Lamson very fine sandy loam. This nearly level soil is in depressional areas on the lake plain, mainly near the beach ridges in Brady Township. It is easily tilled.

Included with this soil in mapping are small areas of the somewhat poorly drained Kibbie soils that occur on slight rises that are generally adjacent to drainageways. Also included are areas of Colwood and Millgrove soils where Kibbie soils adjoin this Lamson soil.

Seasonal wetness is the major limitation for farming, but this soil drains readily when artificial drainage is installed. A seasonal high water table is the major limitation for most nonfarm uses.

Most areas have been cleared and are used for cultivated crops. This soil is well suited to farming if the excess water is removed. It has severe limitations for most recreational and urban developments. Capability unit IIw–9; woodland suitability 4w.

Landes Series

The Landes series consists of nearly level, well drained to moderately well drained soils on flood plains. These soils formed in alluvial deposits along the larger streams in the county.

In a representative profile the surface layer is very dark grayish brown sandy loam 11 inches thick. The subsoil, from 11 to 25 inches, is brown fine sandy loam and sandy loam. The substratum to a depth of 60

inches is brown and dark yellowish brown sandy loam and loamy sand.

Landes soils have a deep root zone and moderate available water capacity. Organic-matter content is high in the surface layer. Permeability is moderately rapid in the surface layer and rapid in the subsoil and substratum. These soils are subject to flooding, mostly in winter and spring.

Landes soils are well suited to farming. They are also well suited to openland wildlife. Limitations for most nonfarm uses are severe.

Most areas are used for cultivated crops, principally corn and soybeans. Some areas are in pasture or woodland. Because of the hazard of damage by flooding, these soils are rarely used for wheat or other winter grains.

Representative profile of Landes sandy loam in a cultivated field SE¼NE¼NE¼SE¼ sec. 33, St. Joseph Township; T. 6 N., R. 1 E., 70 feet west of State Route 49 and 50 feet east of the St. Joseph River:

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) sandy loam; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21—11 to 17 inches; brown (10YR 4/3) fine sandy loam; moderate medium granular structure; friable; many fine roots; neutral; abrupt wavy boundary.

B22—17 to 25 inches; brown (10YR 4/3) sandy loam; very weak medium subangular blocky structure; friable; few fine roots; mildly alkaline; clear smooth boundary.

C1—25 to 32 inches; dark yellowish brown (10YR 4/4) sandy loam; massive; friable; few fine roots; mildly alkaline; clear smooth boundary.

C2—32 to 43 inches; dark yellowish brown (10YR 4/4) coarse sandy loam; common fine distinct dark grayish brown (10YR 4/2) mottles; massive; loose; few fine roots; mildly alkaline; abrupt smooth boundary.

C3—43 to 60 inches; brown (10YR 4/3) loamy sand; common medium faint dark grayish brown (10YR 4/2) mottles; massive; loose; calcareous; moderately alkaline; abrupt smooth boundary.

The depth to carbonates ranges from 28 to 45 inches. The thickness of the solum ranges from 18 to 30 inches.

The A horizon is generally 10 to 16 inches thick and is 10YR hue, value of 3, and chroma of 2 or 3. Reaction ranges from neutral to mildly alkaline.

The B horizon is 10YR hue, value of 4 or 5, and chroma of 3 or 4. The texture is sandy loam, fine sandy loam, and loam. Some pedons have strata of loamy sand. Reaction is neutral to mildly alkaline.

The C horizon is 10YR or 2.5Y hue, value of 4 or 5, and chroma of 3 or 4, and in places it is mottled. The texture ranges from sandy loam to sand with some thin layers of silt loam. Reaction is mildly alkaline to moderately alkaline. In some areas this horizon is calcareous. Some pedons have layers of fine gravel.

Landes soils are the well to moderately well drained members of a drainage sequence that includes the very poorly drained Cohoctah and the somewhat poorly drained Ceresco soils. They are similar to Eel and Genesee soils but are less clayey and more sandy.

Lb—Landes sandy loam. This nearly level soil occurs as long, fairly wide strips on flood plains. This soil occupies slight rises commonly near the streambanks. In some areas it occurs as broad flats that cover most of the flood plain. This soil has good tilth and is easy to manage.

Included with this soil in mapping are spots of sandier soils. Also included are small areas of the wetter Ceresco soils and areas of the less sandy Genesee and Eel soils.

Flooding is the dominant limitation for farming and for many nonfarm uses.

Most areas are used for cultivated crops, principally corn and soybeans. This soil is well suited to farming if flooding is controlled. It has severe limitations for recreational and urban developments. Capability unit IIw-1; woodland suitability 1o.

Latty Series

The Latty series consists of nearly level, very poorly drained soils formed in lacustrine clay. These soils occur as broad areas on the lake plain.

In a representative profile the surface layer is dark gray silty clay 9 inches thick. The subsoil, from 9 to 53 inches, is mottled, gray and dark gray clay and silty clay. The substratum, from 53 to 69 inches, is gray clay.

Latty soils have a deep root zone when drained and a moderate available water capacity. Permeability is very slow. The soils are saturated for significant periods in winter and spring, and they dry slowly unless adequately drained. Surface runoff is slow, and ponding occurs in depressions.

Latty soils are well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas are used for cultivated crops. A few are wooded.

Representative profile of Latty silty clay in a clover field NE¼SE¼SE¼NE¼ sec. 31, Springfield Township; T. 6 N., R. 4 E., 35 feet south of field boundary and 90 feet west of small barn:

Ap—0 to 9 inches; dark gray (10YR 4/1) silty clay; weak coarse prismatic structure; very firm; many fine roots; neutral; abrupt smooth boundary.

B21g—9 to 16 inches; dark gray (5Y 4/1) silty clay; few medium distinct brown (10YR 4/3) mottles; weak coarse prismatic structure parting to moderate medium and fine angular blocky; firm; many fine roots; mildly alkaline; clear smooth boundary.

B22g—16 to 22 inches; gray (5Y 5/1) clay; many fine distinct dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic structure parting to moderate medium and fine angular blocky; firm; common fine roots; neutral; gradual smooth boundary.

B23g—22 to 40 inches; gray (5Y 5/1) clay; many fine distinct dark brown (10YR 4/3) and

olive brown (2.5Y 4/4) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; firm; common fine roots; mildly alkaline; gradual smooth boundary.

B3g—40 to 53 inches; gray (5Y 5/1) silty clay; many fine distinct dark brown (10YR 4/3), dark yellowish brown (10YR 4/4), and olive brown (2.5Y 4/4) mottles; weak medium prismatic structure parting to weak medium and fine angular blocky; firm; few fine roots; mildly alkaline; clear wavy boundary.

Cg—53 to 69 inches; gray (5Y 5/1) clay; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak thick platy structure; firm; light gray (10YR 7/1) lime segregations on faces of peds; calcareous; mildly alkaline.

The depth to carbonates ranges from 38 to 60 inches.

The Ap horizon is generally 7 to 9 inches thick and is 10YR or 2.5Y hue, value of 4, and chroma of 1 or 2. Reaction ranges from slightly acid to neutral.

The B horizon is 10YR to 5Y hue, value of 4 or 5, and chroma of 1 or 2, and is mottled. The texture is clay or silty clay and ranges from 45 to 60 percent clay. Reaction ranges from neutral to mildly alkaline.

The C horizon is 10YR to 5Y hue, value of 4 or 5, and chroma of 1 through 4, and it is mottled. It is stratified with clay and silty clay, but some pedons have thin layers of clay loam.

Latty soils are similar to Toledo, Hoytville, and Paulding soils. They have a lighter colored surface layer than Toledo soils. They differ from Hoytville soils, which formed in glacial till, in not having pebbles. They are less clayey than Paulding soils.

Le—Latty silty clay. This nearly level soil occurs as broad areas on the lake plain. It is clayey and difficult to till. This soil crusts following heavy rains, which sometimes adversely affects seedling stands. This soil is subject to cracking when dry.

Included with this soil in mapping are small areas of the finer textured Paulding soils. These areas are mainly along the line between the Latty and Paulding soils in the eastern part of the county. Also included in some areas are spots of Hoytville, Fulton, Del Rey, and Nappanee soils and a few small areas of Haskins and Mermill soils.

Soil wetness and clayey texture are the major limitations for farming. The soil dries slowly in spring. Artificial drainage is difficult to attain. Seasonal wetness and very slow permeability are limitations for many nonfarm uses. The clayey surface layer is also a severe limitation for recreational use.

This soil is moderately well suited to farming if the excess water is removed. Most areas are used for crops. Some are wooded. The soil has severe limitations for most recreational and urban developments. Capability unit IIIw-2; woodland suitability 3w.

Lenawee Series

The Lenawee series consists of nearly level, poorly to very poorly drained soils that formed in stratified lake sediments mainly of silty clay loam and clay loam. These soils occur as broad areas on the lake plain and as basinlike areas on the till plain.

In a representative profile the surface layer is dark grayish brown silty clay loam 10 inches thick. The subsoil from 10 to 36 inches is mottled, grayish brown and gray silty clay and from 36 to 46 inches is dark yellowish brown silty clay loam. The substratum from 46 to 62 inches is mottled, dark yellowish brown silty clay loam lacustrine material.

Lenawee soils have a deep root zone when drained. Permeability is moderately slow. These soils have a high available water capacity and a seasonal high water table. They are saturated for long periods in winter and spring. These soils warm and dry slowly in spring unless adequately drained. Ponding occurs in depressional areas.

Lenawee soils are well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Lenawee silty clay loam, in a cultivated field NW¼NW¼NW¼SE¼ sec. 10, Springfield Township; T. 6 N., R. 4 E., 45 feet south of County Road E-50 and 275 feet east of hickory tree:

Ap1—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay loam; weak medium subangular blocky structure parting to moderate medium granular; friable; many fine roots; very dark grayish brown (10YR 3/2) coatings on faces of peds; slightly acid; abrupt smooth boundary.

Ap2—5 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate medium and coarse angular blocky structure; firm; many fine roots; very dark grayish brown (10YR 3/2) coatings on faces of peds; slightly acid; abrupt smooth boundary.

B21g—10 to 18 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate fine angular blocky; firm; common fine roots; dark grayish brown (10YR 4/2) coatings on faces of peds; neutral; gradual wavy boundary.

B22g—18 to 31 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; very weak medium prismatic structure parting to moderate medium and fine angular blocky; very firm; common fine roots; common fine dark concretions; neutral; abrupt wavy boundary.

B31g—31 to 36 inches; gray (10YR 5/1) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; medium subangular blocky structure; firm; few fine roots; common light gray (10YR 7/1) lime segregations on faces of peds; common dark concretions; calcareous; mildly alkaline; clear wavy boundary.

B32—36 to 46 inches; dark yellowish brown

(10YR 4/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few fine roots; grayish brown (10YR 5/2) coatings on faces of peds; common light gray (10YR 7/1) lime segregations and concretions; few fine dark concretions; calcareous; mildly alkaline; abrupt smooth boundary.

C1—46 to 56 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct gray (10YR 6/1) mottles; very weak coarse subangular blocky structure; friable; few fine roots; gray (10YR 6/1) coatings on faces of peds; common light gray (10YR 7/1) lime concretions; few fine dark concretions; calcareous; mildly alkaline; abrupt smooth boundary.

C2—56 to 62 inches; dark yellowish brown (10YR 4/4) silty clay loam with thin strata of silt loam; common medium distinct gray (10YR 6/1) mottles; moderate medium platy structure; friable; few fine roots; gray (10YR 6/1) coatings on faces of peds; common light gray (10YR 7/1) lime concretions; few fine dark stains; calcareous; mildly alkaline.

The depth to carbonates and the thickness of the solum range from 30 to 50 inches.

The A horizon is generally 7 to 10 inches thick. It is 10YR hue, value of 4, and chroma of 1 or 2. Reaction is slightly acid or neutral.

The B horizon is 10YR or 2.5Y hue, value of 4 or 5, and chroma of 1 through 4, and it is mottled. The texture is clay loam, silty clay loam, and silty clay. Reaction ranges from slightly acid to mildly alkaline. In some areas this horizon is calcareous in the lower part.

The C horizon is stratified silty clay loam, clay loam, silt loam, and silty clay and thin strata of fine sand. This horizon is 10YR to 5Y hue, value of 4 through 6, and chroma of 1 through 4, and it is mottled.

Lenawee soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Del Rey soils and the moderately well drained Shinrock soils. They occur on positions similar to Bono, Toledo, and Colwood soils. They contain slightly less clay than Bono and Toledo soils and have a slightly lighter colored surface layer than Bono soils. Lenawee soils are more clayey and have less strata of silt and fine sand than Colwood soils.

Lenawee soils in the survey area have a slightly lighter colored surface layer than Lenawee soils mapped elsewhere, but this difference does not affect their use and management.

Lf—Lenawee silty clay loam. This nearly level soil occurs as broad areas on the lake plain and in small depressional areas in other parts of the county. This soil becomes cloddy if worked when too wet and commonly crusts following heavy rains.

Included with this soil in mapping are small areas of Del Rey, Toledo, and Latty soils. These soils generally occur adjacent to their boundaries with Lenawee soils. Also included are a few spots of the lighter textured Colwood soils.

Seasonal wetness is the major limitation for farming. Ponding occurs in depressional areas. Seasonal wetness and moderately slow permeability are limitations for many nonfarm uses.

Most areas have been cleared and are used for cultivated crops. Some areas are wooded. This soil is well suited to farming if the excess water is removed. It has severe limitations for most recreational and urban developments. Capability unit IIw-6; woodland suitability 2w.

Lucas Series

The Lucas series consists of gently sloping to steep, moderately well drained soils that formed in lacustrine silty clay and clay. These soils occur along the streams that dissect the lake plain.

In a representative profile the surface layer is dark grayish brown silty clay loam 5 inches thick. The subsurface layer, from 5 to 8 inches, is mottled pale brown silty clay loam. The subsoil, from 8 to 39 inches, is mottled, yellowish brown and dark yellowish brown silty clay. The substratum to a depth of 60 inches is mottled, dark yellowish brown silty clay.

Lucas soils have a moderately deep root zone and a moderate available water capacity. Permeability is slow in the subsoil and slow or very slow in the substratum.

These soils are moderately to poorly suited to farming. Limitations for most nonfarm uses are severe.

Most areas have been cleared and are used for pasture or cultivated crops. A few are wooded.

Representative profile of Lucas silty clay loam, 12 to 25 percent slopes, moderately eroded, in an idle field SW¼SW¼NE¼SE¼ sec. 23, Springfield Township; T. 6 N., R. 4 E., 0.2 mile south of farm lane and 40 feet north of walnut tree:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A2—5 to 8 inches; pale brown (10YR 6/3) silty clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak thin platy structure parting to moderate fine angular blocky; firm; common fine roots; medium acid; abrupt smooth boundary.

B21t—8 to 13 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium and fine angular blocky structure; firm; few fine roots; thick very patchy clay films on vertical faces of peds; strongly acid; gradual wavy boundary.

B22t—13 to 17 inches; dark yellowish brown (10YR 4/4) silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium and fine angular blocky structure; very firm; few fine roots; thick continuous dark brown (7.5YR 4/4) clay films on vertical and horizontal faces of peds; medium acid; gradual wavy boundary.

B23t—17 to 28 inches; dark yellowish brown

(10YR 4/4) silty clay; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; very firm; few fine roots; few fine distinct grayish brown (10YR 5/2) mottles below 22 inches; thin continuous brown (10YR 4/3) clay films on vertical and horizontal faces of peds; common fine distinct very dark grayish brown (10YR 3/2) stains; neutral; gradual smooth boundary.

B3t—28 to 39 inches; dark yellowish brown (10YR 4/4) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; very firm; thin patchy brown (10YR 4/3) clay films on vertical faces of peds; common medium distinct light gray (10YR 7/1) lime segregations; neutral; abrupt smooth boundary.

C—39 to 60 inches; dark yellowish brown (10YR 4/4) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure; very firm; calcareous; moderately alkaline.

The depth to carbonates ranges from 24 to 40 inches. The thickness of the solum ranges from 27 to 40 inches.

The Ap horizon is generally 4 to 8 inches thick and is 10YR hue, value of 4 or 5, and chroma of 2 or 3. Reaction ranges from strongly acid to neutral.

The B horizon is 10YR hue, value of 4 or 5, and chroma of 3 or 4, and it is mottled. Some pedons have chroma of 2 in the lower B horizon. The texture is silty clay or clay. Reaction ranges from strongly acid to neutral.

The C horizon consists of stratified silty clay or clay. It is 10YR to 2.5Y hue, value of 4 or 5, and chroma of 2 through 4, and it is mottled. Reaction is mildly or moderately alkaline. This horizon is calcareous.

Lucas soils are the moderately well drained members of a drainage sequence that includes the somewhat poorly drained Fulton and the very poorly drained Toledo and Bono soils. Lucas soils are similar to Shinrock, St. Clair, and Glynwood soils. They have a slightly higher clay content than Shinrock soils. In contrast with St. Clair and Glynwood soils, they are stratified and lack glacial pebbles.

LuB2—Lucas silty clay loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil occurs as long, narrow strips on slope breaks along drainageways. In most areas slopes are short. The present surface layer is somewhat sticky and cloddy because plowing has mixed some of the material from the clayey subsoil with the original surface layer. This soil is subject to crusting after heavy rains, and this crusting adversely affects seedling stands.

Included with this soil are small areas of the wetter Fulton soils at the base of slopes or in depressional areas. Also included are a few sandy spots that resemble Seward soils and are commonly identified by a spot symbol on the soil map.

A severe erosion hazard is the major limitation for farming. The slow or very slow permeability is a limitation for some nonfarm uses.

This soil is moderately suited to farming if protected from erosion. It has moderate to severe limitations for recreational and urban developments. Most areas are used for crops and pasture. Capability unit IIIe-2; woodland suitability 3c.

LuC2—Lucas silty clay loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on narrow slope breaks along drainageways. Slopes are typically short. This soil is moderately eroded. The present surface layer is sticky and cloddy because much of the original surface layer has been removed by erosion. The present surface layer is a mixture of material from the clayey subsoil and what is left of the original surface layer. Crusting, which commonly adversely affects seedling stands, is a serious problem on this soil.

Included with this soil in mapping are a few sandy spots that resemble Seward soils and that are commonly identified by a spot symbol on the soil map.

A very severe erosion hazard is the major limitation for farming. Slope is also a limitation to the use of farm machinery. The slow or very slow permeability and the slope are limitations for many nonfarm uses.

This soil is moderately suited to farming if protected from erosion. Most areas are used for crops and pasture. A few are wooded. The soil has moderate to severe limitations for recreational and urban developments. Capability unit IVe-1; woodland suitability 3c.

LuD2—Lucas silty clay loam, 12 to 25 percent slopes, moderately eroded. This moderately steep to steep soil occurs as narrow areas along drainageways. The profile is the one described as representative of the series. In cultivated areas, the present surface layer is sticky and cloddy because some of the original surface layer has been removed by erosion. Plowing has mixed some material from the clayey subsoil with the original surface layer. In woodland and pasture areas this soil has more of the original surface layer, but this layer is still thin.

Included with this soil in mapping are a few severely eroded areas. Some are gullied. Some areas of Tuscola variant, which are near the Tiffin River and are stratified with silt and fine sand, are also included.

A very severe erosion hazard is the major limitation for crops, pasture, and woodland. The slope severely limits this soil for cultivated crops. Surface runoff is rapid, and the hazard of erosion is very severe. Slow or very slow permeability and slope are limitations for many nonfarm uses.

About half the acreage is in pasture and meadow, but some is used for row crops. Many areas are wooded. This soil is poorly suited to farming. It has severe limitations for most recreational and urban developments. Capability unit VIe-1; woodland suitability 3c.

Martisco Series

The Martisco series consists of level, very poorly drained organic soils occurring in depressional areas and formed in woody and fibrous materials over marl.

In a representative profile the upper 10 inches is very dark brown muck. Below this, from 10 to 37 inches, is light gray and gray marl. Gray loam and silt loam are between 37 and 70 inches.

Martisco soils have a shallow to moderately deep

root zone and a moderate available water capacity. Permeability is moderate or moderately rapid in the organic layer and slow or moderately slow in the marl and mineral substrata. The organic surface layer is susceptible to soil blowing if exposed. Ponding is common unless the soil is artificially drained.

Martisco soils are well suited to farming if the excess water is removed and the surface is protected from soil blowing. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe. These soils are generally poorly suited to woodland.

Most areas are still in the original bog condition or are cleared and pastured.

Representative profile of Martisco muck in a wooded area NW¼SW¼SW¼ sec. 35, Jefferson Township; T. 7 N., R. 3 E., 200 feet southeast of railroad and 450 feet north of County Road G:

O21—0 to 5 inches; very dark brown (10YR 2/2) muck, 3 percent fibers, none rubbed; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

O22—5 to 10 inches; very dark brown (10YR 2/2) silty muck; weak very fine subangular blocky structure; friable; many fine roots; 50 percent mineral; mildly alkaline; abrupt smooth boundary.

C1—10 to 22 inches; light gray (5Y 7/1) marl; few medium distinct pale brown (10YR 6/3) mottles; moderate coarse prismatic structure; firm; common fine roots; calcareous; moderately alkaline; clear wavy boundary.

C2—22 to 32 inches; gray (5Y 6/1) marl; many medium prominent strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure; friable; few fine roots; 10 percent fine shells; dark gray (5Y 4/1) coatings on faces of prisms; calcareous; moderately alkaline; clear smooth boundary.

C3g—32 to 37 inches; gray (5Y 5/1) marl; many medium prominent strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure; friable; 2 percent fine shells; dark gray (5Y 4/1) coatings on faces of prisms; few fine pebbles; calcareous; moderately alkaline; clear smooth boundary.

IIC4g—37 to 51 inches; gray (N 5/0) loam; many medium prominent dark brown (7.5YR 4/4) mottles; massive; friable; few fine snail shells in upper part; 3 percent fine gravel; common very dark grayish brown (10YR 3/2) concretions; calcareous; moderately alkaline; abrupt smooth boundary.

IIC5g—51 to 70 inches; gray (N 5/0) silt loam; common fine prominent dark brown (7.5YR 4/4) mottles; massive; firm; few fine pebbles; few very dark gray (10YR 3/1) concretions; calcareous; moderately alkaline.

The depth to carbonates and the thickness of the organic layers range from 8 to 16 inches.

The O2 horizons are black or very dark brown in 10YR hue, value of 2, and chroma of 1 or 2. The content of mineral material ranges from 0 to 60 percent. Reaction is neutral or mildly alkaline.

The upper part of the C horizon is marl 25 to 40 inches thick. It is 10YR to 5Y hue, value of 5 through 7, and chroma of 0 through 2, and is mottled. Reaction is moderately alkaline. This horizon is calcareous.

The lower part of the C horizon is mineral and is 10YR to 5Y hue or neutral, value of 4 through 6, and chroma of 0 through 2. The texture ranges from fine sandy loam to silty clay loam. Reaction is moderately alkaline. This horizon is calcareous.

Martisco soils are similar to Edwards and Carlisle soils but have thinner organic layers than those soils.

Ma—Martisco muck. This level soil lies in oval or long depressional areas on uplands. Areas range up to 25 acres in size.

Included with this soil in mapping are narrow strips of Pewamo soils that are around the edges of most areas. Also included are small areas of Edwards and Carlisle soils near the centers of some areas. A few spots have marl near or at the surface.

Excess soil wetness and the hazard of soil blowing are the major limitations for farming. Ponding commonly occurs after rains unless the soil is drained. Some areas are difficult to drain because they are depressional. A seasonal high water table and ponding are limitations for most nonfarm uses.

Most areas are still in the original bog condition, but some have been cleared and are pastured. This soil is suited to farming if the excess water is removed and the surface is protected from soil blowing. It has severe limitations for most recreational and urban developments. Capability unit IVw-1; woodland suitability 5w.

Mermill Series

The Mermill series consists of nearly level, very poorly drained soils. These soils formed in loamy outwash materials and the underlying clayey lacustrine or glacial till. They occur as broad areas on the lake plain, till plains, or moraines.

In a representative profile the surface layer is very dark grayish brown loam 9 inches thick. The subsoil, from 9 to 28 inches, is mottled, dark grayish brown sandy clay loam and sandy loam, and from 28 to 39 inches, is mottled, gray and dark yellowish brown clay. The substratum, from 39 to 60 inches, is mottled, brown clay.

Mermill soils have a moderately deep root zone and a moderate available water capacity. Permeability is moderate in the surface layer and in the upper part of the subsoil and very slow in the lower part of the subsoil and in the substratum. The soils are saturated for significant periods. Subsurface drainage is effective in removing excess water.

Mermill soils are well suited to farming. They are also well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Mermill soils are used mostly for cultivated crops and meadow, but a few areas are wooded. Most of the cultivated acreage is artificially drained.

Representative profile of Mermill loam in a culti-

vated field NW¼NE¼NE¼ sec. 34, Jefferson Township; T. 7 N., R. 3 E., 0.3 mile east of U.S. Route 127 on County Road H, 150 feet south of County Road H, and 18 feet east of field boundary:

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

B21g—9 to 14 inches; dark grayish brown (10YR 4/2) sandy clay loam; common fine faint olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure; friable; many fine roots; many medium faint very dark grayish brown (10YR 3/2) organic stains; 2 percent medium pebbles; neutral; clear smooth boundary.

B22tg—14 to 18 inches; dark grayish brown (10YR 4/2) sandy clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; many fine roots; common fine faint very dark grayish brown (10YR 3/2) organic stains; thin patchy clay films on faces of peds; 5 percent fine and medium pebbles; neutral; clear wavy boundary.

B23g—18 to 28 inches; dark grayish brown (10YR 4/2) sandy loam; common medium distinct gray (5Y 5/1) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common fine roots; thin patchy clay films on faces of peds and bridging sand grains; 5 percent fine and medium pebbles; neutral; abrupt wavy boundary.

IIB31tg—28 to 31 inches; gray (10YR 5/1) clay; few medium distinct yellowish brown (10YR 5/6) and many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; common fine roots; thin patchy clay films on faces of peds; 4 percent pebbles; calcareous; mildly alkaline; clear smooth boundary.

IIB32tg—31 to 39 inches; dark yellowish brown (10YR 4/4) clay; many medium distinct gray (5Y 5/1) and brown (10YR 4/3) mottles; moderate coarse prismatic structure parting to moderate coarse angular blocky; very firm; few fine roots; thin patchy clay films on vertical faces of peds; 5 percent pebbles; calcareous; moderately alkaline; gradual wavy boundary.

IIC—39 to 60 inches; brown (10YR 4/3) clay; common fine distinct gray (5Y 5/1) and yellowish brown (10YR 5/4) mottles; massive; very firm; 5 percent pebbles; calcareous; moderately alkaline.

The depth to carbonates and the thickness of the solum range from 24 to 48 inches. The depth to the clayey lower subsoil ranges from 20 to 40 inches. The gravel content ranges from 0 to 10 percent in the A and B horizons above the clayey part.

The Ap horizon is generally 7 to 9 inches thick and is 10YR hue, value of 2 or 3, and chroma of 1 or 2. Reaction ranges from slightly acid to neutral.

The B horizon is 10YR to 5Y hue, value of 4 or 5, and chroma of 1 or 2, and it is mottled. The texture ranges from sandy loam to clay loam. Reaction ranges from slightly acid to neutral.

The IIB and IIC horizons are 10YR to 5Y hue, value of 4 or 5, and chroma of 1 through 4 and are mottled. The texture ranges from heavy clay loam to silty clay or clay. Reaction ranges from neutral to moderately alkaline. In some areas these horizons are calcareous. The pebble content is 2 to 6 percent where the IIC horizon is glacial till.

Mermill soils are the very poorly drained members of a drainage sequence that includes the moderately well drained Rawson soils and the somewhat poorly drained Haskins soils. Mermill soils differ from Millgrove soils in having a clayey layer within a depth of 20 to 40 inches.

Md—Mermill loam. This nearly level soil occurs as long, broad strips throughout the county on the lake plain, till plains, and moraines.

Included with this soil in mapping are small areas of Haskins soils on slight rises or knolls. Also included are narrow strips of Hoytville and Pewamo soils adjacent to the boundary of this soil. A few spots of Millgrove soil are also included. In a few areas this soil has a clay loam surface layer and poorer tilth.

Seasonal wetness is the major limitation for farming, but artificial drainage is effective. Seasonal wetness is also the major limitation for nonfarm uses. Very slow permeability in the underlying clay and a high frost-action potential are also limitations for some nonfarm uses.

This soil is well suited to farming if the excess water is removed (fig. 2). Most areas are used for cultivated crops and meadow, but a few are wooded. The soil has severe limitations for most recreational and urban developments. Capability unit IIw-6; woodland suitability 2w.

Millgrove Series

The Millgrove series consists of nearly level, very poorly drained soils. These soils formed in loamy outwash and the underlying poorly stratified fine gravelly and sandy deposits containing some finer textured sediments. They occur as broad areas on outwash plains and smaller tracts adjacent to beach ridges and along drainageways.

In a representative profile the surface layer is very dark gray loam 11 inches thick. The subsoil, from 11 to 31 inches, is mottled, grayish brown and light grayish brown loam, clay loam, and sandy clay loam. The substratum to a depth of 60 inches is mottled, light brownish gray gravelly sand.

Millgrove soils have a deep root zone and a high available water capacity. Permeability is moderate in the surface layer and subsoil and moderately rapid in the substratum. The soils are seasonally saturated and have a high water table for significant periods during

Figure 2.—Crops grow well on Mermill loam if this soil is adequately drained.

winter and spring but drain readily with artificial drainage.

Millgrove soils are well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas are used for cultivated crops. A few are wooded.

Representative profile of Millgrove loam, in a cultivated field SE¼NW¼SW¼ sec. 2, Bridgewater Township; T. 10 S., R. 3 W., 350 feet south of County Road N–60 and 800 feet east of County Road 10:

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam; moderate medium granular structure; friable; common fine roots; 2 percent coarse fragments; neutral; abrupt smooth boundary.

A12—7 to 11 inches; very dark gray (10YR 3/1) loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; 2 percent coarse fragments; neutral; clear wavy boundary.

B21tg—11 to 16 inches; grayish brown (10YR 5/2) clay loam; common medium distinct yellowish brown (10YR 5/6) and dark gray (N 4/0) mottles; weak medium subangular blocky structure; friable; few fine roots; 2 percent coarse fragments; thin very patchy grayish brown (10YR 5/2) clay films on faces of peds; neutral; clear smooth boundary.

B22tg—16 to 20 inches; grayish brown (2.5Y 5/2) clay loam; common medium distinct yellowish brown (10YR 5/4) and gray (5Y 5/1) mottles; weak medium subangular blocky structure; friable; few fine roots; 2 percent coarse fragments; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; neutral; clear smooth boundary.

B23g—20 to 23 inches; light brownish gray (2.5Y 6/2) loam; common medium faint grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure; friable; few fine roots; 2 percent coarse fragments; mildly alkaline; clear smooth boundary.

IIB3—23 to 31 inches; grayish brown (2.5Y 5/2) sandy clay loam; common medium

distinct yellowish brown (10YR 5/4) and dark gray (N 4/0) mottles; very weak coarse subangular blocky structure; friable; 4 percent coarse fragments; mildly alkaline; gradual wavy boundary.

IIC—31 to 60 inches; light brownish gray (10YR 6/2) gravelly sand; common fine distinct yellowish brown (10YR 5/6) mottles; single grained; discontinuous strata of clay loam and loam; 30 percent fine gravel; calcareous; moderately alkaline.

The depth to carbonates ranges from 30 to 45 inches. The depth to the gravelly and sandy materials ranges from 28 to 45 inches. The gravel content ranges from 2 to 15 percent in the solum and from 10 to 45 percent in the C horizon.

The A horizon is generally 10 to 13 inches thick and is 10YR hue, value of 2 or 3, and chroma of 1 or 2. The texture is loam or clay loam. Reaction ranges from slightly acid to neutral.

The B horizon is 10YR to 5Y hue, value of 4 through 6, and chroma of 1 or 2, and it is mottled. The texture ranges from sandy clay loam to clay loam and loam. Reaction ranges from slightly acid to mildly alkaline.

The C horizon is 10YR or 2.5Y hue, value of 4 through 6, and chroma of 2 through 4, and it is mottled. Reaction is moderately alkaline. This horizon is calcareous.

Millgrove soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Digby soils, the moderately well drained Haney soils, and the well drained Belmore soils.

Millgrove soils are similar to Mermill, Colwood, and Gilford soils. In contrast with Mermill soils, they lack a clayey layer within a depth of 40 inches. Millgrove soils have fine and medium sands throughout, but Colwood soils have fine sand and silt. They have more clay and less sand in the subsoil than Gilford soils.

Mh—Millgrove loam. This nearly level soil occurs as broad areas on outwash plains and stream terraces and as narrow strips adjacent to drainageways and on foot slopes of beach ridges. The profile of this soil is the one described as representative of the series. This soil is friable, has good tilth, and is easy to keep in good tilth. The available water capacity is slightly lower than in Millgrove clay loam.

Included with this soil in mapping are small areas of Mermill soil, commonly near the boundary of this soil. Small areas of Haskins and Digby soils occur on slight rises. A few spots of the finer textured Hoytville, Pewamo, Toledo, and Latty soils occur near the edge of this soil in some areas.

Seasonal wetness is the major limitation for farming. The excess water drains readily when this soil is artificially drained. Seasonal wetness is also the principal limitation for many nonfarm uses.

This soil is well suited to farming if the excess water is removed. Most areas are used for cultivated crops. Some are wooded. The soil has severe limitations for most recreational and urban developments. Capability unit IIw–6; woodland suitability 2w.

Mk—Millgrove clay loam. This nearly level soil is in fairly broad strips on outwash plains and on stream terraces. The profile has more clay in the surface layer and subsoil than the one described as representative of the series. The rainfall infiltration rate is somewhat lower, but this soil has a slightly higher available water capacity. It is moderately friable, and tilth is fairly good. Some surface crusting occurs, however, and adversely affects seedling emergence. Somewhat more power is required for tillage on this soil than on the Millgrove loam.

Included with this soil in mapping are small areas of Digby and Haskins soils on low rises. Small areas of Mermill soils and the finer textured Pewamo, Hoytville, Toledo, and Latty soils are also included in places. These areas are commonly near the edge of this soil.

Seasonal wetness is the major limitation for farming and is also the principal limitation for many nonfarm uses.

This soil is well suited to farming if the excess water is removed. Most areas are used for cultivated crops. Some are wooded. The soil has severe limitations for most recreational and urban developments. Capability unit IIw–6; woodland suitability 2w.

Nappanee Series

The Nappanee series consists of nearly level and gently sloping, somewhat poorly drained soils that formed in glacial till on the lake plain. This till has been leveled and reworked by the action of glacial lake waters.

In a representative profile the surface layer is dark grayish brown silty clay loam 8 inches thick. The subsoil, from 8 to 38 inches, is mottled, dark yellowish brown and dark brown clay, silty clay, and silty clay loam. The substratum to a depth of 60 inches is mottled, dark brown silty clay glacial till.

Nappanee soils have a moderately deep root zone and a moderate available water capacity. Permeability is very slow in the subsoil and substratum. These soils are saturated for significant periods in winter and spring and dry slowly unless drained.

Nappanee soils are moderately well suited to farming if the excess water is removed. They are well suited to openland wildlife. Limitations for most nonfarm uses are severe.

Most areas are used for cultivated crops. A few are wooded.

Representative profile of Nappanee silty clay loam, 0 to 2 percent slopes, in a cultivated field NE¼NW¼ SE¼NE¼ sec. 4. Pulaski Township; T. 6 N., R. 3 E., 250 feet north of County Road F–75 and 1,650 feet east of County Road 15:

Ap1—0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam; weak coarse and medium subangular blocky structure parting to moderate medium granular; firm; many fine roots; 2 percent angular stone fragments; few dark concretions; slightly acid; abrupt smooth boundary.

Ap2—4 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate medium angular blocky structure; firm; many fine roots; 2 percent angular stone fragments; few dark concretions; some

earthworm channels; neutral; abrupt smooth boundary.

B21t—8 to 13 inches; dark yellowish brown (10YR 4/4) clay; many fine faint grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; firm; common fine roots; thin patchy clay films; 2 percent angular stone fragments; few rounded pebbles; common dark concretions; neutral; clear smooth boundary.

B22t—13 to 21 inches; dark yellowish brown (10YR 4/4) silty clay; many fine distinct gray (10YR 5/1) mottles; strong fine angular blocky structure; very firm; common fine roots; thin continuous clay films; 2 percent angular stone fragments; few dark concretions; mildly alkaline; gradual wavy boundary.

B23t—21 to 30 inches; dark brown (10YR 4/3) silty clay; many medium distinct gray (10YR 5/1) mottles; moderate medium and coarse prismatic structure parting to moderate fine and medium angular blocky; very firm; common fine roots; thin patchy clay films; 3 percent stone fragments; light gray (10YR 7/1) lime concretions; calcareous; mildly alkaline; gradual wavy boundary.

B3t—30 to 38 inches; dark brown (10YR 4/3) silty clay loam; moderate coarse prismatic structure parting to moderate medium angular blocky; very firm; few fine roots; thin very patchy clay films; 3 percent coarse fragments; light gray (10YR 7/1) lime concretions and stains; calcareous; mildly alkaline; clear wavy boundary.

C—38 to 60 inches; dark brown (10YR 4/3) silty clay; common coarse distinct gray (10YR 5/1) mottles; massive; very firm; 3 percent coarse fragments; light gray (10YR 7/1) lime stains; calcareous; moderately alkaline.

The depth to carbonates ranges from 18 to 36 inches. The thickness of the solum ranges from 22 to 42 inches. The glacial pebble and fragment content ranges from 1 to 8 percent throughout the profile.

The Ap horizon is generally 6 to 9 inches thick and is 10YR hue, value of 4 or 5, and chroma of 2 or 3. The texture is loam or silty clay loam. Reaction ranges from medium acid to neutral.

The B horizon is mottled in 10YR and 2.5Y hue, value of 4 or 5, and chroma of 2 through 4. The texture ranges from heavy silty clay loam to clay or silty clay. Reaction ranges from medium acid to neutral in the upper part and neutral to mildly alkaline in the lower part. This horizon is calcareous in the lower part.

The C horizon is 10YR or 2.5Y hue, value of 4 or 5, and chroma of 2 or 3, and it is mottled. The texture is silty clay loam, silty clay, or clay. Reaction is moderately alkaline. This horizon is calcareous.

Nappanee soils are the somewhat poorly drained members of a drainage sequence that includes the moderately well drained St. Clair soils and very poorly drained Hoytville soils. Nappanee soils are similar to Blount soils but have a more clayey subsoil. They are near Del Rey and Fulton soils but contain more pebbles and stone fragments and lack stratification.

NnA—Nappanee loam, 0 to 2 percent slopes. This nearly level soil is on slight rises and in long strips adjacent to small drainageways. The profile has less clay in the surface layer than the one described as representative of the series. The rainfall infiltration rate is slightly higher in this soil than in the one described as representative of the series. This soil is friable. Tilth is fairly easy to maintain. Ponding is common on some areas.

Included with this soil in mapping are small areas that have a silt loam surface layer. Also included are small areas of Del Rey and Fulton soils that lack glacial pebbles.

Seasonal wetness is the major limitation for farming. Seasonal wetness and very slow permeability are limitations for many nonfarm uses.

This soil is well suited to farming if the excess water is removed. Most areas are used for cultivated crops. The soil has severe limitations for most recreational and urban developments. Capability unit IIIw-3; woodland suitability 3w.

NnB—Nappanee loam, 2 to 6 percent slopes. This gently sloping soil occcurs as long, narrow to moderately wide strips on slope breaks adjacent to drainageways. The profile has less clay in the surface layer than the one described as representative of the series. The rainfall infiltration rate is slightly higher in this soil than in the one described as representative of the series. The surface layer is friable, and tilth is fairly easy to maintain. Less power is required to till this soil than is needed for the Nappanee silty clay loam soil. Runoff is rapid.

Included with this soil in mapping are small areas where the surface layer is silt loam. A few moderately eroded areas have a silty clay loam surface layer. Spots of Del Rey and Fulton soils are near the edge of some areas. Small areas of the more loamy or sandy Haskins and Rimer soils occur in a few places.

A moderate erosion hazard and severe seasonal wetness are limitations for farming. Erosion control and artificial drainage are needed. Seasonal wetness and very slow permeability are limitations for many nonfarm uses. Slope is a limitation for a few nonfarm uses.

This soil is well suited to farming if erosion is controlled and if the excess water is removed. Most areas are used for cultivated crops. The soil has a severe limitation for most recreational and urban developments. Capability unit IIIw-3; woodland suitability 3w.

NpA—Nappanee silty clay loam, 0 to 2 percent slopes. This nearly level soil occupies scattered slight rises throughout the lake plain. It also occurs as long, narrow to moderately wide strips along small drainageways. The profile is the one described as representative of the series. The surface crusts after heavy rains, and this adversely affects seedling emergence. Slightly more power is required to till this soil than is needed for the Nappanee loam soil. Ponding is common.

Included in mapping are small areas of Del Rey and Fulton soils near the edge of this soil. A few spots of

the more loamy or sandy Haskins or Rimer soils occur in some areas.

Seasonal wetness is the major limitation for farming. Some soil blowing occurs. Seasonal wetness and very slow permeability are limitations for many nonfarm uses.

This soil is well suited to farming if the excess water is removed. Most areas are used for cultivated crops. The soil has severe limitations for most recreational and urban developments. Capability unit IIIw-3; woodland suitability 3w.

Oshtemo Series

The Oshtemo series consists of gently sloping and sloping, well drained soils. These soils formed in water-deposited loamy and sandy materials and the underlying sand and gravelly sand. They are on outwash plains and stream terraces and are less commonly on beach ridges and moraines.

In a representative profile the surface layer is very dark grayish brown sandy loam 8 inches thick. The subsoil, from 8 to 38 inches, is dark brown sandy loam and loamy sand; from 38 to 52 inches is dark brown and dark yellowish brown gravelly sandy loam; and from 52 to 66 inches is yellowish brown fine sand. The substratum to a depth of 76 inches is grayish brown gravelly loamy coarse sand.

Oshtemo soils have a deep root zone and a low available water capacity. They are droughty during prolonged dry periods. Organic-matter content is low in the surface layer. Permeability is moderately rapid in the subsoil and rapid in the substratum.

Oshtemo soils are moderately well suited to farming. They are well suited to woodland wildlife. Limitations for most nonfarm uses range from slight to severe.

Most areas are used for cultivated crops. A few are wooded.

Representative profile of Oshtemo sandy loam, 2 to 6 percent slopes, in a cultivated field SE¼NE¼SW¼NW¼ sec. 34, St. Joseph Township; T. 6 N., R. 1 E., 250 feet south and 407 feet west of fences:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam; weak coarse subangular blocky structure parting to moderate fine granular; friable; many fine roots; 3 percent medium gravel; slightly acid; abrupt smooth boundary.

B1—8 to 17 inches; dark brown (7.5YR 4/4) sandy loam; weak medium and fine angular blocky structure; friable; common fine roots; 3 percent medium gravel; neutral; clear smooth boundary.

B21t—17 to 31 inches; dark brown (7.5YR 4/4) loamy sand; weak medium and fine angular blocky structure; friable; common fine roots; thin very patchy dark reddish brown (5YR 3/4) clay films on faces of peds and bridging sand grains; 10 percent gravel; neutral; clear wavy boundary.

B22t—31 to 38 inches; dark brown (7.5YR 4/4) loamy sand; weak medium and fine angular blocky structure; firm; few fine roots; thin patchy dark reddish brown (5YR 3/4) clay films on faces of peds and bridging sand grains; 14 percent gravel; neutral; gradual wavy boundary.

B23t—38 to 44 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak coarse and medium angular blocky structure; firm; few fine roots; thin very patchy dark reddish brown (5YR 3/4) clay films on horizontal faces of peds and bridging sand grains; 18 percent gravel; neutral; clear smooth boundary.

B31t—44 to 52 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; common medium distinct dark reddish brown (5YR 3/4) mottles; weak coarse angular blocky structure; firm; few fine roots; thin patchy dark reddish brown (5YR 3/4) clay films bridging sand grains; 20 percent gravel; neutral; abrupt wavy boundary.

IIB32—52 to 66 inches; yellowish brown (10YR 5/4) fine sand; common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse angular blocky structure; friable; few fine roots; thin very patchy clay films lining some root channels; neutral; clear wavy boundary.

IIIC—66 to 76 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand; stratified, single grained; friable; color grades to yellowish brown (10YR 5/6) with depth; calcareous; moderately alkaline.

The depth to carbonates and the thickness of the solum range from 40 to 66 inches. The gravel content of the solum ranges from 1 to 25 percent.

The Ap horizon is generally 7 to 10 inches thick and is 10YR hue, value of 3 or 4, and chroma of 2 or 3. The texture is loamy sand or sandy loam. Unless limed, this horizon is medium acid or slightly acid.

The Bt horizon is 5YR or 7.5YR hue, value of 4 or 5, and chroma of 3 through 6. The texture ranges from heavy loamy sand to light sandy clay loam and in places is gravelly. In some pedons this horizon is in layers one eighth to 2 inches thick. Reaction ranges from medium acid to neutral.

The C horizon is 10YR hue, value of 5 or 6, and chroma of 2 or 3. The texture is stratified with gravelly sand and sand. Reaction is mildly alkaline or moderately alkaline. This horizon is calcareous.

Oshtemo soils are the well drained members of a drainage sequence that also includes the well drained Boyer soils and the very poorly drained Gilford soils. Oshtemo soils resemble Boyer soils, but they have a thicker solum. They are near the moderately well drained and finer textured Haney soils and the well drained Belmore soils. They resemble Belmore soils but have less clay throughout the subsoil.

OrB—Oshtemo loamy sand, 2 to 6 percent slopes. This gently sloping soil is on the crest and upper slopes of beach ridges and on stream terraces and is less commonly on ridges of the Wabash Moraine. It has a sandier surface layer and subsoil than is described as representative of the series. The rainfall infiltration rate is slightly higher and the available water capacity is lower in this soil than in the sandy loam Oshtemo

soil. This soil is very friable, and the surface layer is susceptible to soil blowing.

Included in mapping are small areas of the well drained Belmore and Boyer soils. Also included are spots of the moderately well drained Haney soils and the somewhat poorly drained Digby soils in depressional areas.

Droughtiness is the major limitation for farming. Erosion is a hazard, especially on the more sloping areas. Soil blowing is commonly a more severe hazard than water erosion. Droughtiness, the hazard of seepage, and the sandy surface layer are limitations for some nonfarm uses.

Most areas are used for cultivated crops. Some are wooded. This soil is moderately well suited to farming. It has slight to moderate limitations for most recreational and urban developments. Capability unit IIIs–1; woodland suitability 3s.

OrC—Oshtemo loamy sand, 6 to 12 percent slopes. This sloping soil is on the slope breaks of stream terraces and on the side slopes of morainic ridges. It has a sandier surface layer and subsoil than is described as representative of the series. This soil has a slightly lower available water capacity than the sandy loam Oshtemo soil. The surface layer is very friable and susceptible to soil blowing.

Included in mapping are small areas of the well drained Belmore and Boyer soils and the moderately well drained Haney soils. Also included are a few areas where the surface layer is sandy loam.

A severe erosion hazard is the major limitation for farming. Droughtiness is also a limitation for most crops. Slope and the hazard of seepage are limitations for some nonfarm uses.

Most areas are used for cultivated crops. Some are wooded. This soil is moderately well suited to farming if erosion is controlled. It has a moderate to severe limitation for most recreational and urban developments. Capability unit IIIe–4; woodland suitability 3s.

OsB—Oshtemo sandy loam, 2 to 6 percent slopes. This gently sloping soil is on the crests and upper slopes of beach ridges and on stream terraces, and it is less commonly on ridges in the Wabash Moraine. Its profile is the one described as representative of the series. The surface layer is friable, has good tilth, and is easy to keep in good tilth.

Included in areas of this soil on beach ridges are spots of Belmore and Haney soils. Small areas of Boyer soils are commonly included with this soil on stream terraces.

Droughtiness is the major limitation for farming. Erosion is also a hazard, especially on the more sloping areas. Some soil blowing occurs, but it is less of a problem on this soil than on the loamy sand Oshtemo soil. Droughtiness and the hazard of seepage are limitations for some nonfarm uses.

Most areas are used for cultivated crops. Some are wooded. This soil is moderately well suited to farming. It has a slight to moderate limitation for most recreational and urban developments. Capability unit IIIs–1; woodland suitability 3s.

Ottokee Series

The Ottokee series consists of moderately well drained, nearly level and gently sloping sandy soils. These soils formed in water deposited sands. They occur throughout the county.

In a representative profile the surface layer is dark grayish brown fine sand 9 inches thick. The subsoil, from 9 to 32 inches, is yellowish brown and brown fine sand and, from 32 to 50 inches, brown and grayish brown loamy fine sand. The substratum to a depth of 80 inches is grayish brown sand.

Ottokee soils have a deep root zone but a low available water capacity. They are droughty during prolonged dry periods. Permeability is rapid. The soils are subject to soil blowing.

Ottokee soils are suited to farming if protected from soil blowing. They are moderately suited to openland or woodland wildlife. Limitations for many nonfarm uses are moderate to severe.

Most areas have been cleared and are used for cultivated crops and pasture. A few are wooded.

Representative profile of Ottokee fine sand, 0 to 6 percent slopes, in a cultivated field NE¼NW¼SW¼SE¼ sec. 10 Northwest Township; T. 9 S., R. 4 W., 0.2 mile north of County Road S, 0.35 mile west of State Route 49:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sand; weak medium subangular blocky structure parting to weak medium granular; very friable; many fine roots; very dark grayish brown (10YR 3/2) coatings on faces of peds; 2 percent fine and medium gravel; neutral; abrupt smooth boundary.

B21—9 to 21 inches; yellowish brown (10YR 5/4) fine sand; very weak fine and medium subangular blocky structure; very friable; common fine roots; 5 percent fine and medium gravel; slightly acid; gradual wavy boundary.

B22—21 to 32 inches; brown (10YR 5/3) fine sand; single grained; loose; few fine roots; 6 percent fine and medium gravel; slightly acid; abrupt wavy boundary.

B23t&B31—32 to 37 inches; brown (10YR 4/3) loamy fine sand; weak medium platy structure parting to weak fine subangular blocky; friable; few fine roots; discontinuous layers of grayish brown (2.5Y 5/2) fine sand B3 material; medium acid; abrupt wavy boundary.

B32—37 to 44 inches; grayish brown (10YR 5/2) loamy fine sand; single grained; loose; few fine roots; slightly acid; clear wavy boundary.

B33&B24t—44 to 50 inches; grayish brown (10YR 5/2) loamy fine sand; single grained; loose; few fine roots; discontinuous; brown (10YR 4/3) loamy fine sand lamellae ¼ to ¾ inch thick, with very weak medium subangular blocky structure; slightly acid; abrupt wavy boundary.

C—50 to 80 inches; grayish brown (10YR 5/2) sand; single grained; loose; few discontinuous lamellae 1/16 to ⅛ inch thick in upper 10 inches; neutral grading to mod-

erately alkaline and calcareous with depth.

The depth to carbonates and the thickness of the solum range from 45 to 90 inches.

The Ap horizon is generally 7 to 10 inches thick. It is 10YR hue, value of 3 or 4, and chroma of 2 or 3. Reaction ranges from medium acid to neutral.

All the B horizon but the Bt is 10YR or 2.5Y hue, value of 5 or 6, and chroma of 4 through 6 in the upper part and 2 through 4 in the lower part. Texture is fine sand or loamy fine sand. Reaction ranges from medium acid to neutral.

The depth to the first Bt lamellae ranges from 30 to 45 inches lamellae thickness ranges from 1/16 to ¼ inch. Color is 10YR to 5YR hue and value and chroma of 3 or 4. The Bt horizon is loamy fine sand and is slightly higher in clay content than material between the lamellae. Total thickness of the bands in most profiles is less than 6 inches.

The C horizon is fine to medium sand in 10YR or 2.5Y hue, value of 5 or 6, and chroma of 2 or 3. It is moderately alkaline and is calcareous. The sand is commonly underlain by lacustrine clay or by glacial clay or clay loam till at depths of 4 to 10 feet.

Ottokee soils are the moderately well drained members of a drainage sequence that includes the well drained Spinks soils. They resemble Seward soils but lack the firm clay loam to clay lower subsoil and substratum. They are more mottled than the similar Arkport soils and have slightly less clay in the lamellae.

OtB—Ottokee fine sand, 0 to 6 percent slopes. This nearly level to gently sloping soil is on beach ridges and moraines or in long narrow strips on stream terraces. The organic-matter content is low. This soil is very susceptible to soil blowing.

Included with this soil in mapping are small areas of Seward soils and a few areas of somewhat poorly drained soils. These wetter areas commonly occur at the base of sandy ridges.

Droughtiness is the major limitation. Water erosion is a hazard in the more sloping areas. Soil blowing is a greater hazard. Droughtiness, the sandy texture, and the hazard of seepage are limitations for nonfarm uses.

Most areas of this soil are used for crops. A few are wooded. This soil is moderately well suited to farming if protected from erosion. It has moderate to severe limitations for most recreational and urban developments. Capability unit IIIs-1; woodland suitability 3s.

Paulding Series

The Paulding series consists of nearly level, very poorly drained clayey soils. These soils formed in lacustrine clays. They occur as broad areas on the lake plain.

In a representative profile the surface layer is dark grayish brown clay 6 inches thick. The subsoil, from 6 to 53 inches, is mottled, dark gray and dark grayish brown clay. The substratum to a depth of 61 inches is mottled, brown lacustrine clay.

Paulding soils generally have a deep root zone and a moderate available water capacity. The surface layer is moderate to high in organic matter. Permeability is slow. The soils are saturated for significant periods in winter and spring and dry slowly in spring. Surface runoff is slow, and ponding occurs in some areas.

Paulding soils are moderately well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas have been cleared and are used for cultivated crops and pasture. A few are wooded.

Representative profile of Paulding clay in a cultivated field SE¼SW¼SE¼SE¼ sec. 36, Springfield Township; T. 6 N., R. 4 E., 150 feet north of County Road A:

Ap—0 to 6 inches; dark grayish brown (2.5Y 4/2) clay; few fine distinct brown (10YR 4/3) and dark yellowish brown (10YR 4/4) mottles; moderate medium angular blocky structure; very firm; many fine roots; medium acid; abrupt smooth boundary.

B21g—6 to 11 inches; dark gray (10YR 4/1) clay; many fine distinct dark yellowish brown (10YR 4/4) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; very firm; many fine roots; common fine distinct reddish brown (5YR 4/4) stains; medium acid; clear smooth boundary.

B22g—11 to 22 inches; dark gray (5Y 4/1) clay; common fine distinct dark yellowish (10YR 4/4) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; very firm; common fine roots; medium acid; gradual smooth boundary.

B23g—22 to 37 inches; dark gray (5Y 4/1) clay; common fine distinct dark yellowish (10YR 4/4) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse angular blocky structure; very firm; few fine roots; few fine distinct brown (7.5YR 4/4) stains on faces of peds; slightly acid; gradual wavy boundary.

B24g—37 to 49 inches; dark grayish brown (2.5Y 4/2) clay; few fine distinct dark yellowish brown (10YR 4/4) and few medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium angular blocky; very firm; few fine roots; neutral; gradual smooth boundary.

B3g—49 to 53 inches; dark grayish brown (10YR 4/2) clay; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; very firm; common light gray (10YR 7/1) lime segregations; calcareous; mildly alkaline; gradual wavy boundary.

C—53 to 61 inches; brown (10YR 4/3) clay; common medium distinct dark gray (5Y 4/1) mottles; massive; firm; light gray (10YR 7/1) lime segregations; spots of till-like material containing a few pebbles; calcareous; mildly alkaline.

The depth to carbonates and the thickness of the solum range from 36 to 55 inches.

The Ap horizon is from 6 to 9 inches thick and is 2.5Y or 10YR hue, value of 4, and chroma of 1 or 2. Reaction ranges from medium acid to neutral.

The B horizon is 10YR to 5Y hue or neutral, value of 4 through 6, and chroma of 0 through 2. The mottles are commonly lighter chroma. The texture ranges from 60 to 75 percent clay. Reaction ranges from medium acid to mildly alkaline. In some areas this horizon is calcareous in the lower part.

The C horizon is 10YR to 5Y hue or neutral, value of 4 or 5, and chroma of 0 through 3, and it is mottled. Reaction is moderately alkaline or mildly alkaline. This horizon is calcareous. Glacial till occurs immediately below the solum in some pedons.

Paulding soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Roselms soils. They resemble Latty soils but are more clayey. They are similar to Toledo and Bono soils but have a lighter colored surface layer and are more clayey. They occur near Hoytville soils but have more clay and do not have glacial pebbles.

Pa—Paulding clay. This nearly level soil occurs as broad areas of the lake plain. The high clay content makes tillage difficult, and seedbeds are commonly cloddy. Air and water movement is very slow. This soil is subject to crusting after heavy rains, but cracks form readily in dry weather.

Soil variations are minor in most areas. Included with this soil in mapping are small areas of Latty soils near the edge of some areas and spots of Toledo soils along the drainageways. Small areas of Roselms soils on low rises are also included.

Wetness is the major limitation for farming. This soil is difficult to drain because of the very slow permeability. The clayey surface layer makes good tilth difficult to maintain. Seasonal wetness and very slow permeability are limitations for most nonfarm uses. The hazard of ponding and the clayey surface layer are also limitations for many nonfarm uses.

Most areas are used for crops and pasture. This soil is moderately well suited to farming if the excess water is removed. It has severe limitations for recreational and urban developments. Capability unit IIIw-2; woodland suitability 3w.

Pewamo Series

The Pewamo series consists of nearly level, very poorly drained soils that formed in glacial till. These soils are in slightly depressional areas on the till plain and moraines.

In a representative profile the surface layer is very dark grayish brown silty clay loam 9 inches thick. The subsurface layer is very dark gray silty clay. The subsoil, from 11 to 46 inches, is dark gray, gray, and dark yellowish brown, mottled, firm silty clay. The substratum, from 46 to 72 inches, is mottled, dark yellowish brown silty clay and silty clay loam glacial till with mottles in the upper part.

Pewamo soils have a deep root zone and a high available water capacity. Permeability is moderately slow. The soils are saturated for significant periods in winter and spring and dry slowly in spring unless adequately drained. Ponding occurs in depressional areas.

Pewamo soils are well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas are used for cultivated crops or pasture. A few are wooded.

Representative profile of Pewamo silty clay loam in a cultivated field SE¼NW¼NW¼NE¼ sec. 9, Center Township; T. 6 N., R. 2 E., 120 feet south of State Route 34 and 115 feet west of fence along west side of implement shed:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam; weak coarse granular structure; friable; many fine roots; 3 percent small pebbles; medium acid; abrupt smooth boundary.

A12—9 to 11 inches; very dark gray (10YR 3/1) silty clay; moderate medium and fine angular blocky structure; friable; many fine roots; 3 percent small pebbles; slightly acid; abrupt smooth boundary.

B21t—11 to 17 inches; dark gray (10YR 4/1) silty clay; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure parting to weak fine angular blocky; friable; common fine roots; thin very patchy dark grayish brown (10YR 4/2) clay films on horizontal and vertical faces of peds; 3 percent small pebbles; slightly acid; gradual wavy boundary.

B22t—17 to 25 inches; gray (N 5/0) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine and medium angular blocky; firm; common fine roots; thin patchy dark grayish brown (10YR 4/2) clay films on horizontal and vertical faces of peds; 3 percent small pebbles; neutral; gradual smooth boundary.

B23t—25 to 38 inches; gray (N 5/0) silty clay; common fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; thin patchy gray (N 4/0) clay films on horizontal and vertical faces of peds; 3 percent small pebbles; neutral; clear wavy boundary.

B3t—38 to 46 inches; dark yellowish brown (10YR 4/4) silty clay; common fine distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; weak coarse and medium angular blocky structure; firm; few fine roots; thin very patchy gray (N 5/0) clay films on vertical faces of peds; 3 percent small pebbles; mildly alkaline; clear wavy boundary.

C1—46 to 61 inches; dark yellowish brown (10YR 4/4) silty clay; fine distinct yellowish brown (10YR 5/6) and few fine distinct gray (N 5/0) mottles; very weak

coarse angular blocky structure; firm; thick continuous gray (N 5/0) coatings on faces of peds; 3 percent small pebbles; calcareous; mildly alkaline; gradual wavy boundary.

C2—61 to 72 inches; dark yellowish brown (10YR 4/4) silty clay loam; massive; firm; thin continuous gray (N 5/0) coatings on cleavage planes; common light brownish gray (10YR 6/2) lime segregations; calcareous; mildly alkaline.

The depth to carbonates and the thickness of the solum range from 28 to 50 inches. The pebble content ranges from 0 to 15 percent.

The A horizon is generally 10 to 16 inches thick and is 10YR hue, value of 2 or 3, and chroma of 1 or 2. The texture is silty clay loam or loam. Reaction ranges from medium acid to neutral.

The B2 horizon is 10YR to 5Y hue or neutral, value of 4 through 6, and chroma of 0 through 2, and it is mottled. The texture is heavy clay loam, heavy silty clay loam, clay, or silty clay. Reaction ranges from slightly acid to mildly alkaline.

The C horizon is 10YR to 5Y hue, value of 4 or 5, and chroma of 1 through 4, and it is mottled. The texture of the till is mainly clay loam or silty clay loam but ranges from loam to silty clay. Reaction is moderately alkaline or mildly alkaline. This horizon is calcareous.

Pewamo soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Blount soils and the moderately well drained Glynwood soils. Pewamo soils are similar to Hoytville soils but have a slightly thicker, dark colored surface layer.

Pm—Pewamo silty clay loam. This nearly level soil occurs as broad flats on till plains and as long, narrow strips along drainageways on moraines and till plains. This soil becomes cloddy if worked when too wet and is subject to crusting after heavy rains.

Included with this soil in mapping are a few areas of Pewamo loam. Also included, near the edge of this soil, are small areas of Blount, Haskins, and Mermill soils. Areas of this soil that occur on the Wabash Moraine have a loam texture in the substratum. In a few areas this soil formed in 1 or 2 feet of lacustrine clays over the till.

Seasonal wetness is the major limitation for farming. Seasonal wetness and moderately slow permeability are limitations for many nonfarm uses.

This soil is well suited to farming if the excess water is removed. Most areas are used for cultivated crops. Some are wooded. The soil has severe limitations for recreational and urban developments. Capability unit IIw-7; woodland suitability 2w.

Rawson Series

The Rawson series consists of gently sloping and sloping, moderately well drained soils that formed in water-deposited loamy materials and the underlying clay loam to clay lacustrine or glacial till. These soils occur on beach ridges, outwash plains, stream terraces, and, in places, on moraines.

In a representative profile the surface layer is dark grayish brown sandy loam 9 inches thick. The upper part of the subsoil, from 9 to 34 inches, is mottled, dark yellowish brown, yellowish brown, and brown sandy loam, loam, and sandy clay loam. The lower part of the subsoil, from 34 to 43 inches, is mottled, dark yellowish brown clay loam. The substratum to a depth of 60 inches is brown clay loam glacial till.

Rawson soils have a moderately deep root zone and a moderate available water capacity. Permeability is moderate in the surface layer and upper part of the subsoil and slow or very slow in the lower part of the subsoil and in the substratum.

Rawson soils are well suited to farming. They are also well suited to openland wildlife. Limitations for many nonfarm uses are slight to moderate.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Rawson sandy loam, 2 to 6 percent slopes, in a cultivated field NE¼NW¼NE¼ SW¼ sec. 11, St. Joseph Township; T. 6 N., R. 1 E., 219 feet east of trees, 145 feet north of County Road, and 35 feet west of telephone pole:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy loam; weak medium angular blocky structure parting to weak fine granular; friable; many fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

B1—9 to 13 inches; dark yellowish brown (10YR 4/4) sandy loam; weak thick platy structure parting to moderate fine angular blocky; friable; few fine roots; 2 percent gravel; neutral; gradual wavy boundary.

B21t—13 to 20 inches; yellowish brown (10YR 5/4) sandy loam; few fine faint brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to moderate fine angular blocky; friable; few fine roots; thin very patchy brown (10YR 4/3) clay films on faces of peds and bridging sand grains; 3 percent gravel; neutral; gradual wavy boundary.

B22t—20 to 29 inches; brown (7.5YR 4/4) loam; common fine distinct yellowish brown (10YR 5/6) and, below 25 inches, grayish brown (10YR 5/2) mottles; moderate thick platy structure parting to moderate fine angular blocky; friable; thin very patchy brown (10YR 4/3) clay films on faces of peds and bridging sand grains; 2 percent gravel; slightly acid; clear wavy boundary.

B23t—29 to 34 inches; dark yellowish brown (10YR 4/4) sandy clay loam; common fine distinct grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure parting to moderate medium angular blocky; firm; thin patchy brown (10YR 4/3) clay films on faces of peds and bridging sand grains; 5 percent gravel; medium acid; abrupt smooth boundary.

IIB24t—34 to 43 inches; dark yellowish brown (10YR 4/4) clay loam; common medium

distinct dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) mottles; moderate coarse and medium angular blocky structure; firm; thin patchy brown (10YR 4/3) clay films on faces of peds; 2 percent glacial pebbles; mildly alkaline; abrupt smooth boundary.

IIC—43 to 60 inches; brown (10YR 4/3) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; 2 percent glacial pebbles; calcareous; moderately alkaline.

The depth to carbonates and the thickness of the solum range from 26 to 46 inches. The gravel content ranges from 2 to 15 percent in the upper part of the solum and from 0 to 5 percent in the lower part of the solum and in the substratum.

The Ap horizon is generally 6 to 9 inches thick and is 10YR hue, value of 4 or 5, and chroma of 2 or 3. Texture is sandy loam or loam. Reaction ranges from medium acid to neutral.

The B2 horizon is 7.5YR or 10YR hue, value of 4 or 5, and chroma of 3 through 5, and it is mottled. The texture ranges from heavy sandy loam or loam to clay loam. Reaction ranges from medium acid to neutral.

The IIB2 horizon is 10YR hue, value of 4 or 5, and chroma of 1 through 4, and it is mottled. The texture ranges from clay loam to silty clay or clay. Reaction ranges from neutral to moderately alkaline. In places this horizon is calcareous.

The IIC horizon is 10YR hue, value of 4 or 5, and chroma of 3 or 4. The texture is mainly clay or silty clay but includes silty clay loam and clay loam. Reaction is moderately alkaline. This horizon is calcareous.

Rawson soils are the moderately well drained members of a drainage sequence that includes the very poorly drained Mermill soils and the somewhat poorly drained Haskins soils. Rawson soils are similar to Haney soils in the upper part of the profile but have a more clayey lower subsoil and substratum. Unlike Haney soils, they are not underlain by sand and gravel. They are similar to Seward soils but are less sandy in the upper part of the profile.

RlB—Rawson sandy loam, 2 to 6 percent slopes. This gently sloping soil is on beach ridges, stream terraces, moraines, and low ridges on outwash plains. The profile is the one described as representative of the series. This soil is very friable, has good tilth, and is easy to keep in good tilth. It has a slightly higher infiltration rate but a lower available water capacity than Rawson loam soils.

Included with this soil in mapping are small areas of Haney and Glynwood soils that are commonly near the edge of this soil. Spots of Oshtemo and Boyer soils are included on the stream terraces and, in some places, on beach ridges.

A moderate erosion hazard is the major limitation for farming. Droughtiness is a minor limitation. The very slow permeability in the substratum is a limitation for some nonfarm uses.

This soil is well suited to farming if erosion is controlled. Most areas are used for crops. Some are wooded. The soil has a slight or moderate limitation for many recreational and urban developments. Capability unit IIe–1; woodland suitability 2o.

RlC—Rawson sandy loam, 6 to 12 percent slopes. This sloping soil is on beach ridges, stream terraces, moraines, and ridges on outwash plains. The profile of this soil has a thinner surface layer than that described as representative of the series. Infiltration rates are slightly higher on this soil than on Rawson loam soils. This soil is very friable, has good tilth, and is easy to keep in good tilth.

Included with this soil in mapping are small areas of Haney and Glynwood soils, commonly near the boundary with this soil. Spots of Oshtemo and Boyer soils are included on stream terraces and, in some places, on the moraines. A few moderately steep areas are also included.

A severe erosion hazard is the major limitation for farming. A droughtiness hazard is a minor limitation. Slope and very slow permeability in the substratum are limitations for many nonfarm uses.

This soil is moderately well suited to farming if erosion is controlled. Most areas are used for crops and pasture. A few are wooded. The soil has a moderate or severe limitation for most recreational and urban developments. Capability unit IIIe–1; woodland suitability 2o.

RmB—Rawson loam, 2 to 6 percent slopes. This gently sloping soil occurs as moderately sized strips or as low knolls on beach ridges, stream terraces, moraines, and low ridges on outwash plains. The profile of this soil is less sandy than that described as representative of the series and has a slightly higher available water capacity. The surface layer is friable, has good tilth, and is easy to keep in good tilth.

Included with this soil in mapping are small areas of Haney soils. Also included are a few areas of Glynwood soils on moraines. Spots of Oshtemo and Boyer soils on stream terraces and, in some places, on beach ridges and moraines are also included. A few areas are nearly level.

A moderate erosion hazard is the major limitation for farming. Very slow permeability in the substratum is a limitation for some nonfarm uses.

This soil is well suited to farming if erosion is controlled. Most areas are used for crops. A few are wooded. The soil has a slight or moderate limitation for most recreational and urban developments. Capability unit IIe–1; woodland suitability 2o.

RmC—Rawson loam, 6 to 12 percent slopes. This sloping soil is on the slope breaks of stream terraces and on moraines. The slopes are moderate to short. Surface runoff is rapid. The profile of this soil is less sandy and has a slightly higher available water capacity than that described as representative of the series.

Included with this soil in mapping are spots of Oshtemo and Boyer soils on stream terraces. These are generally near the edge of this soil. Also included are a few areas that are moderately steep.

A severe erosion hazard is the major limitation for farming. Slope and slow permeability in the substratum are the dominant limitations for nonfarm uses.

Most areas are used for crops. Some are wooded. This soil is moderately well suited to farming if erosion is controlled. It has moderate or severe limitations for most recreational and urban developments. Capability unit IIIe–1; woodland suitability 2o.

Rimer Series

The Rimer series consists of nearly level, somewhat poorly drained soils that formed in sandy water-deposited materials and in the underlying clay to clay loam lacustrine sediment or glacial till. These soils are on the lake plain, stream terraces, beach ridges, and moraines.

In a representative profile the surface layer is dark brown loamy fine sand 9 inches thick. The subsoil, from 9 to 24 inches, is mottled, dark brown and brown loamy fine sand and fine sandy loam, and from 24 to 32 inches, is dark yellowish brown silty clay. The substratum, from 32 to 63 inches, is dark yellowish brown and light olive brown stratified clay loam to sand.

Rimer soils have a moderately deep root zone and a low to moderate available water capacity. Permeability is rapid to moderately rapid in the surface layer and in the upper part of the subsoil and very slow in the lower part of the subsoil and in the substratum. Soil blowing is a moderate hazard.

Rimer soils are moderately well suited to farming if the excess water is removed. They are moderately well suited to openland wildlife. Limitations for most nonfarm uses are severe.

Most areas are used for cultivated crops. A few are wooded.

Representative profile of Rimer loamy fine sand, 0 to 3 percent slopes, in a cultivated field NE¼SE¼SE¼SE¼ sec. 23, Springfield Township; T. 6 N., R. 4 E., 60 feet north of fence corner and 27 feet east of line fence:

Ap—0 to 9 inches; dark brown (10YR 4/3) loamy fine sand; very weak medium subangular blocky structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

B11—9 to 12 inches; dark brown (10YR 4/3) loamy fine sand; common medium distinct light brownish gray (10YR 6/2) and few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium platy structure; very friable; common fine roots; few fine distinct very dark brown (10YR 2/2) concretions; strongly acid; clear wavy boundary.

B12—12 to 21 inches; brown (10YR 5/3) loamy fine sand; common medium distinct dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) mottles; very weak medium subangular blocky structure; friable; few fine roots; few fine distinct very dark brown (10YR 2/2) concretions; strongly acid; abrupt wavy boundary.

B21t—21 to 24 inches; dark brown (7.5YR 4/4) heavy fine sandy loam; common fine distinct yellowish brown (10YR 5/4) mottles; moderate medium and fine angular blocky structure; firm; light brownish gray (10YR 6/2) coatings on faces of peds; thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.

IIB22t—24 to 32 inches; dark yellowish brown (10YR 4/4) silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse and medium angular blocky structure; firm; grayish brown (10YR 5/2) coatings on faces of peds; thin patchy clay films, on vertical faces of peds; few fine distinct black (10YR 2/1) stains; slightly acid; gradual wavy boundary.

IIIC1—32 to 49 inches; dark yellowish brown (10YR 4/4) clay loam; massive; firm; neutral, abrupt smooth boundary.

IVC2—49 to 63 inches, light olive brown (2.5Y 5/4) stratified sand and clay loam; common fine distinct light brown (7.5YR 6/4) and few fine distinct light brownish gray (10YR 6/2) mottles; single grained; loose; few fine distinct very dark brown (10YR 2/2) stains and concretions; mildly alkaline.

The thickness of the solum ranges from 24 to 44 inches. The sandy layers in the upper part of the solum range from 20 to 38 inches in thickness. The gravel content of the upper part of the solum ranges from 0 to 5 percent.

The Ap horizon is commonly 6 to 10 inches thick and is 10YR hue, value of 4, and chroma of 2 or 3. Reaction ranges from medium acid to neutral.

The B1 horizon is 10YR hue, value of 4 or 5, and chroma of 2 through 6. It is mottled. The texture is loamy fine sand or fine sand. The reaction ranges from strongly acid to neutral.

The B2 horizon is 7.5YR or 10YR hue, value of 4 or 5, and chroma of 3 through 6 and is mottled. The texture is sandy loam or fine sandy loam but includes thin layers of sandy clay loam. Reaction ranges from strongly acid to neutral.

The IIB horizon is 10YR or 2.5Y hue, value of 4 through 6, and chroma of 1 through 4. The texture is clay loam, clay, or silty clay. Reaction ranges from slightly acid to mildly alkaline.

The C horizon has colors similar to the IIB horizon. It is stratified with the dominant textures being clay loam, clay, and silty clay.

Rimer soils are the somewhat poorly drained members of a drainage sequence that includes the moderately well drained Seward soils. Rimer soils are similar to Haskins soils but are more sandy in the upper part of the profile.

RnA—Rimer loamy fine sand, 0 to 3 percent slopes. This nearly level soil is on low ridges or knolls on the lake plain, beach ridges, stream terraces, and in places on the moraines and till plain. This soil is very friable, has good tilth, and is easy to keep in good tilth.

Included with this soil in mapping are small areas of Haskins soils near the edge of some areas. Also included, in the low spots, are areas of the wetter Mermill soils.

Seasonal wetness is the major limitation for farming. Droughtiness is a minor hazard, especially for crops requiring a long growing season and large amounts of moisture. Seasonal wetness, a sandy surface layer, and very slow permeability in the substratum are limitations for many nonfarm uses.

Most areas are used for crops. A few are wooded. This soil is moderately well suited to farming if the excess water is removed and the soil is protected from blowing. It has severe limitations for most recreational and urban developments. Capability unit IIw-4; woodland suitability 2w.

Roselms Series

The Roselms series consists of nearly level and gently sloping, somewhat poorly drained clayey soils. These soils formed in lacustrine clays. They are on the lake plain.

In a representative profile the surface layer is dark grayish brown silty clay 8 inches thick. The subsoil, from 8 to 32 inches, is mottled, dark brown and gray clay. The substratum, from 32 to 60 inches, is yellowish brown clay.

Roselms soils have a moderately deep root zone and a moderate available water capacity. Permeability is very slow. The soils are saturated for significant periods in winter and spring. They dry slowly in spring, even when artificially drained.

Roselms soils are moderately well suited to farming. They are well suited to openland wildlife. Limitations for most nonfarm uses are severe.

Most areas have been cleared and are used for cultivated crops and pasture. A few are wooded.

Representative profile of Roselms silty clay, 0 to 2 percent slopes, in a cultivated field SE¼SE¼SE¼ SW¼ sec 35, Springfield Township; T. 6 N., R. 4 E., 0.6 mile west of State Route 66 and 75 feet north of fence:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay; few fine faint dark brown (7.5YR 4/4) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; firm; many fine roots; medium acid; abrupt smooth boundary.

B21t—8 to 15 inches; dark brown (10YR 4/3) clay; common fine faint dark grayish brown (10YR 4/2) and many medium faint dark yellowish brown (10YR 4/4) mottles; moderate medium and fine prismatic structure; firm; many fine roots; thin very patchy clay films on vertical faces of peds; few fine black (10YR 2/1) concretions; medium acid; clear smooth boundary.

B22t—15 to 19 inches; gray (5Y 5/1) clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to moderate fine angular blocky; firm; common fine roots; grayish brown (2.5Y 5/2) ped surfaces; thin patchy clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3t—19 to 32 inches; dark brown (10YR 4/3) clay; many medium distinct grayish brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; very firm; common fine roots; grayish brown (2.5Y 5/2) ped surfaces; thin patchy clay films on vertical faces of peds; light gray (10YR 7/1) lime segregations; calcareous; mildly alkaline; gradual wavy boundary.

C1—32 to 47 inches; yellowish brown (10YR 5/4) clay; many medium distinct dark grayish brown (2.5Y 4/2) mottles; moderate medium prismatic structure parting to weak coarse angular blocky; firm; few fine roots; gray (5Y 5/1) ped surface; light gray (10YR 7/1) lime segregations; calcareous; mildly alkaline; gradual smooth boundary.

C2—47 to 60 inches; yellowish brown (10YR 5/4) clay; massive, with vertical cleavages; very firm; dark grayish brown (2.5Y 4/2) near cleavage faces, radiating into mass; gray (5Y 5/1) cleavage faces; light gray (10YR 7/1) lime segregations; calcareous; mildly alkaline.

The depth to carbonates ranges from 18 to 30 inches. The thickness of the solum ranges from 24 to 35 inches.

The Ap horizon is generally 5 to 8 inches thick and is 10YR hue, value of 4 or 5, and chroma of 2. Reaction ranges from strongly acid to slightly acid.

The B horizon is 10YR to 5Y hue, value of 4 or 5, and chroma of 1 through 4, and is mottled. The texture is fine clay. Reaction ranges from strongly acid to mildly alkaline. In some areas this horizon is calcareous in the lower part.

The C horizon is 10YR hue, value of 4 through 6, and chroma of 2 through 4. The texture is fine clay. Some minor stratification occurs in pedons with very thin silty or fine sand lenses. Reaction is moderately alkaline or mildly alkaline. This horizon is calcareous.

Roselms soils are the somewhat poorly drained members of a drainage sequence that includes the very poorly drained Paulding soils. They are similar to Fulton soils but have more clay throughout the profile.

RsA—Roselms silty clay, 0 to 2 percent slopes. This nearly level soil occurs on the lake plain as long strips that parallel drainageways and slight rises. The profile is the one described as representative of the series. The silty clay surface layer makes this soil difficult to till.

Included with this soil in mapping are a few areas where the surface layer is loam. These areas are easier to till. Also included are small areas of the wetter Paulding soils that commonly are along drainageways.

Seasonal wetness is the major limitation for farming. Soil wetness and very slow permeability are the dominant limitations for most nonfarm uses.

Most areas have been cleared and are used for cultivated crops and pasture. This soil is moderately well suited to farming if the excess water is removed. It has a severe limitation for most recreational and urban developments. Capability unit IIIw-3; woodland suitability 4w.

RsB—Roselms silty clay, 2 to 6 percent slopes. This gently sloping soil occurs on the lake plain as long strips that parallel drainageways. It is also on slight rises. The profile of this soil has a thinner surface layer than the one described as representative of the

series. Runoff is medium, and erosion is a moderate hazard.

Included with this soil in mapping are a few sloping to moderately steep areas. Also included are areas of the wetter Paulding soils, which are commonly in small drainageways.

Seasonal wetness is the major limitation for farming, but a moderate erosion hazard also limits use. Erosion control is needed. Soil wetness and very slow permeability are limitations for most nonfarm uses.

Most areas have been cleared and are used for cultivated crops and pasture. This soil is moderately well suited to farming if the excess water is removed and erosion is controlled. It has a severe limitation for most recreational and urban developments. Capability unit IIIw-3; woodland suitability 4w.

St. Clair Series

The St. Clair series consists of gently sloping to steep, moderately well drained soils that formed in clay loam or clay glacial till. These soils are on slope breaks along the streams that dissect the lake plain.

In a representative profile the surface layer is dark gray silty clay loam 5 inches thick. The subsoil, from 5 to 21 inches, is mottled, dark yellowish brown clay. The substratum, from 21 to 60 inches, is brown clay and clay loam glacial till.

St. Clair soils have a moderately deep root zone and moderate available water capacity. Permeability is slow to very slow. Runoff is medium to rapid, and erosion is a serious hazard.

St. Clair soils are moderately suited to poorly suited to farming depending on the degree of erosion hazard and slope. They are well suited to moderately well suited to openland wildlife. Limitations for most nonfarm uses are moderate or severe.

Most areas are used for pasture or cultivated crops. A few are wooded.

Representative profile of St. Clair silty clay loam, 12 to 25 percent slopes, moderately eroded, in a pasture field NE¼NW¼SW¼NE¼ sec. 4, Pulaski Township; T. 6 N., R. 3 E., 75 feet south of fence and 85 feet east of northernmost of two hickory trees:

Ap—0 to 5 inches; dark gray (10YR 4/1) silty clay loam; moderate fine granular structure; friable; many fine roots; 1 percent pebbles; slightly acid; abrupt smooth boundary.

B1t—5 to 10 inches; dark yellowish brown (10YR 4/4) clay; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; firm; many fine roots; thin very patchy brown (10YR 4/3) clay films on vertical faces of peds; 2 percent pebbles; neutral; abrupt smooth boundary.

B21t—10 to 16 inches; dark yellowish brown (10YR 4/4) clay; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium and fine angular blocky structure; very firm; few fine roots; thin patchy brown (10YR 4/3) clay films on vertical and horizontal faces of peds; 2 percent pebbles; neutral; gradual wavy boundary.

B22t—16 to 21 inches; dark yellowish brown (10YR 4/4) clay; fine distinct yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; very firm; few fine roots; thin patchy brown (10YR 4/3) clay films on vertical and horizontal faces of peds; 2 percent pebbles; mildly alkaline; abrupt wavy boundary.

C1—21 to 25 inches; brown (10YR 4/3) clay; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; very firm; dark grayish brown (10YR 4/2) ped surfaces; 3 percent pebbles; calcareous; moderately alkaline; abrupt smooth boundary.

C2—25 to 60 inches; brown (10YR 4/3) clay loam; massive; very firm; dark grayish brown (10YR 4/2) surfaces of cleavage plains; 3 percent pebbles; calcareous; moderately alkaline.

The depth to carbonates and the thickness of the solum range from 20 to 30 inches. The gravel or glacial fragment content ranges from 0 to 8 percent throughout.

The Ap horizon is generally 5 to 8 inches thick and is 10 YR hue, value of 4 or 5, and chroma of 1 through 3. Reaction ranges from medium acid to neutral.

The B horizon is 10YR hue, value of 4 or 5, and chroma of 3 or 4, and it is mottled. The texture is clay or silty clay. Reaction ranges from medium acid to neutral.

The C horizon is 10YR hue, value of 4 or 5, and chroma of 2 through 4. The texture is clay, silty clay, or clay loam. Reaction is mildly alkaline or moderately alkaline. The horizon is calcareous.

St. Clair soils are the moderately well drained members of a drainage sequence that includes the somewhat poorly drained Nappanee soils and the very poorly drained Hoytville soils. These soils have a higher clay content directly below the A horizon than the Glynwood soils. In contrast with Shinrock and Lucas soils, they formed in glacial till containing pebbles instead of stratified lacustrine sediments.

SbB2—St. Clair silty clay loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil occurs as long, narrow strips on slope breaks along drainageways. Most slopes are short, generally 4 to 6 percent. The profile has a thicker surface layer than that described as representative of the series. In most areas about 60 to 70 percent is moderately eroded. The present surface layer is somewhat sticky and cloddy because plowing has mixed some of the material from the clayey subsoil with the original surface layer. Surface crusting is common after heavy rains.

Included with this soil in mapping are spots that have a silt loam surface layer. Small areas of Lucas and Shinrock soils are also included near the edge of some areas.

A severe erosion hazard is the main limitation for farming. Slow to very slow permeability and the clayey texture are limitations for some nonfarm uses.

Most areas are used for crops or pasture. Some are wooded. This soil is moderately well suited to farming if protected from erosion. It has moderate or severe limitations for most recreational and urban developments. Capability unit IIIe-2; woodland suitability 3c.

SbC2—St. Clair silty clay loam, 6 to 12 percent slopes, moderately eroded. This sloping soil occupies long, narrow slope breaks along drainageways. Slopes are typically short. About 70 to 80 percent of most areas is moderately eroded. The present surface layer is sticky and cloddy because plowing has mixed some of the material from the clayey subsoil with the original surface layer. Surface crusting is rather severe after heavy rains. The profile has a thicker surface layer than the one described as representative of the series.

Included with this soil in mapping are a few severely eroded spots. Also included, near the edge of this soil, are small areas of Lucas and Shinrock soils

A severe erosion hazard is the main limitation for farming. Slope, slow to very slow permeability, and the high clay content are limitations for many nonfarm uses.

Most areas are used for pasture and crops. Some are wooded. This soil is moderately well suited to farmland if erosion is controlled. It has moderate or severe limitations for most recreational and urban developments. Capability unit IVe-1; woodland suitability 3c.

SbD2—St. Clair silty clay loam, 12 to 25 percent slopes, moderately eroded. This moderately steep to steep soil occurs on slope breaks along the larger drainageways. It occupies long, narrow areas. Slopes are short to moderate. The profile is the one described as representative of the series. About 50 to 70 percent of most areas is moderately eroded. The present surface layer is sticky and cloddy. Much of the original surface layer has been removed by erosion, and plowing has mixed what is left with material from the clayey subsoil.

Included with this soil in mapping are a few areas that are severely eroded. Small areas of Lucas and Shinrock soils near the edge of this soil are also included.

A very severe erosion hazard is the major limitation for crops and pasture used. The slope severely limits use for crops that require tillage. Surface runoff is rapid. Slope and slow to very slow permeability are limitations for most nonfarm uses.

Most areas are wooded. Some are used for pasture. This soil is poorly suited to farming. It has severe limitations for most recreational and urban developments. Capability unit VIe-1; woodland suitability 3c.

Seward Series

The Seward series consists of gently sloping, moderately well drained sandy soils. These soils formed in 20 to 40 inches of sandy material and the underlying glacial till or lacustrine sediments. They occur as sandy ridges and knolls on the lake plain and sandy areas on the beach ridges, stream terraces, and moraines throughout the county.

In a representative profile the surface layer is dark brown loamy fine sand 9 inches thick. The subsurface layer, from 9 to about 23 inches, is yellowish brown and dark yellowish brown loamy fine sand. The subsoil, from 23 to 34 inches, is dominantly dark brown, mottled clay loam. The substratum to a depth of 60 inches is dark brown, mottled clay loam glacial till.

Seward soils have a moderately deep root zone and low available water capacity. Permeability is rapid in the sandy material and very slow in the underlying finer textured substratum.

Seward soils are well suited to farming. Limitations for most nonfarm uses are moderate or severe.

Representative profile of Seward loamy fine sand, 2 to 6 percent slopes, in a cultivated field SE¼SE¼SW¼ NE¼ sec. 19, St. Joseph Township; T. 6 N., R. 1 E., 50 feet north of County Road C-50:

Ap—0 to 9 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable; few fine roots; neutral; abrupt smooth boundary.

A21—9 to 16 inches; yellowish brown (10YR 5/4) loamy fine sand; few fine distinct light yellowish brown (10YR 6/4) mottles; single grained; loose; few fine roots; few fine distinct dark yellowish brown (10YR 4/4) stains; slightly acid; gradual wavy boundary.

A22—16 to 23 inches; dark yellowish brown (10YR 4/4) loamy fine sand, few medium distinct yellowish brown (10YR 5/6) mottles; single grained; very friable; thin very patchy dark brown (7.5YR 4/4) clay films bridging sand grains in lower 1 to 2 inches; slightly acid; abrupt wavy boundary.

B21t—23 to 25 inches; dark yellowish brown (10YR 4/4) fine sandy loam; common medium distinct strong brown (7.5YR 5/6) and few fine distinct pale brown (10YR 6/3) mottles; weak coarse and medium subangular blocky structure; firm; thin very patchy dark brown (10YR 3/3) clay films on faces of peds; few fine distinct very dark brown (10YR 2/2) concretions; slightly acid; abrupt wavy boundary.

IIB22t—25 to 34 inches; dark brown (10YR 4/3) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; grayish brown (2.5YR 5/2) ped surfaces; thin very patchy dark brown (10YR 3/3) clay films on faces of peds; 3 percent coarse fragments; neutral; gradual wavy boundary.

IIC—34 to 60 inches; dark brown (10YR 4/3) clay loam; few fine distinct yellowish brown (10YR 5/6) and gray (N 6/0) mottles; massive; firm; 5 percent coarse fragments; calcareous; moderately alkaline.

The depth to carbonates ranges from 20 to 44 inches The thickness of the solum ranges from 24 to 44 inches. The thickness of the sandy or loamy layers in the upper part of the B horizon ranges from 20 to 40 inches. The gravel content of the solum ranges from 0 to 3 percent

in the upper part and from 0 to 8 percent in the lower part.

The Ap horizon is generally 6 to 10 inches thick and is 10YR hue, value of 4 or 5, and chroma of 2 or 3. Reaction ranges from medium acid to neutral.

The A2 horizon is 10YR hue, value of 4 through 6, and chroma of 3 through 5, and it is mottled. The texture is loamy fine sand or fine sand. Reaction ranges from medium acid to neutral.

The B2 horizon is 7.5YR or 10YR hue, value of 4 or 5, and chroma of 3 or 4, and it is mottled. The texture is sandy loam or fine sandy loam but includes thin layers of sandy clay loam. Reaction is slightly acid or neutral.

The IIB horizon is 10YR hue, value of 3 through 5, and chroma of 3 or 4, and is mottled. The texture is clay loam, clay or silty clay. Reaction ranges from slightly acid to mildly alkaline.

The C horizon has colors and textures similar to the IIB horizon. Reaction is mildly alkaline or moderately alkaline. This horizon is calcareous.

Seward soils are the moderately well drained members of a drainage sequence that includes the somewhat poorly drained Rimer soils. They are similar to Ottokee and Rawson soils. Seward soils have a clay loam to clay lower subsoil and substratum, but Ottokee soils are sandy throughout. The upper part of the profile of Seward soils is more sandy than that of Rawson soils.

SdB—Seward loamy fine sand, 2 to 6 percent slopes. This gently sloping soil is on sandy knolls and low ridges on the lake plain, beach ridges, moraines, and stream terraces. It is very friable, has good tilth, and is easy to keep in good tilth. Erosion and soil blowing are moderate hazards.

Included with this soil in mapping are a few areas that are sloping or moderately steep. Spots of Rimer soils, mainly in depressions or at the base of slopes, are also included. A few areas have inclusions of Ottokee soils.

A moderate erosion hazard is the major limitation for farming. Droughtiness is also a limitation, which adversely affects crops with heavy moisture requirements during extended dry periods. Droughtiness and very slow permeability of the lower layers are limitations for many nonfarm uses.

This soil is well suited to farming if erosion is controlled. Most areas have been cleared and are used for cultivated crops and pasture. The soil has a moderate or severe limitation for most recreational and urban developments. Capability unit IIe-3; woodland suitability 2o.

Shinrock Series

The Shinrock series consists of gently sloping and sloping, moderately well drained soils adjacent to drainageways mainly on the lake plain. These soils formed in stratified lacustrine sediments.

In a representative profile the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil, from 8 to 26 inches, is dark yellowish brown and dark brown silty clay that is mottled in the lower part. The substratum, from 26 to 60 inches, is dark yellowish brown and brown silty clay and silt loam.

Shinrock soils have a deep root zone and a moderate available water capacity. Permeability is moderately slow.

Shinrock soils are moderately well suited to farming if protected from erosion. They are well suited to woodland or openland wildlife. Limitations for most nonfarm uses are moderate or severe.

Most areas of these soils have been cleared and are used for cultivated crops and pasture. A few are wooded.

Representative profile of Shinrock silt loam, 6 to 12 percent slopes, in a pasture SW¼NE¼SW¼NE¼ sec. 6, Springfield Township; T. 6 N., R. 4 E., 210 feet east of County Road 1950, 800 feet south of County Road G:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A2—5 to 8 inches; brown (10YR 5/3) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; pale brown (10YR 6/3) silt coatings on faces of peds; medium acid; abrupt smooth boundary.

B21t—8 to 14 inches; dark yellowish brown (10YR 4/4) silty clay; moderate medium subangular blocky structure parting to moderate fine angular blocky; firm; common fine roots; thin patchy dark brown (10YR 4/3) clay films on vertical and horizontal faces of peds; medium acid; clear smooth boundary.

B22t—14 to 20 inches; dark yellowish brown (10YR 4/4) silty clay; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure parting to moderate medium angular blocky; firm; few fine roots; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; few fine very dark brown (10YR 2/2) stains; slightly acid; clear smooth boundary.

B23t—20 to 26 inches; dark brown (10YR 4/3) silty clay; common fine distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/4) mottles; moderate coarse and medium angular blocky structure; firm; few fine roots; thin patchy dark grayish brown (10YR 4/2) clay films on vertical and horizontal faces of peds; mildly alkaline; clear wavy boundary.

C1—26 to 36 inches; dark yellowish brown (10YR 4/4) silty clay; common fine distinct grayish brown (2.5Y 5/2) and gray (10YR 5/1) mottles; weak coarse angular blocky structure grading with depth to weak medium platy; firm; calcareous; moderately alkaline; abrupt smooth boundary.

IIC2—36 to 46 inches; dark yellowish brown (10YR 4/4) silt loam; common coarse distinct gray (10YR 5/1) and common fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; moderate

medium light gray (10YR 7/1) lime segregations; calcareous; moderately alkaline; abrupt smooth boundary.

IIC3—46 to 60 inches; brown (10YR 5/3) silty clay; common fine distinct gray (N 5/0) mottles; massive with horizontal cleavage planes; firm; gray (N 6/0) and greenish gray (5GY 6/1) coatings on cleavage planes; common medium light gray (10YR 7/1) lime segregations; calcareous; moderately alkaline.

The depth to carbonates ranges from 20 to 32 inches, and the thickness of the solum ranges from 24 to 36 inches.

The Ap horizon is generally 5 to 10 inches thick. It is 10YR hue, value of 4 or 5, and chroma of 2 or 3. The reaction ranges from medium acid to neutral.

The B horizon is 10YR hue, value of 4 or 5, and chroma of 3 or 4, and it is mottled in the lower part. The texture ranges to silty clay, clay, silty clay loam, and clay loam. The reaction ranges from medium acid to mildly alkaline. In places this horizon is calcareous in the lower part.

The C horizon has colors similar to those in the B horizon. It is stratified with silty clay loam, silt loam, and silty clay and has thin lenses of clay loam, loam, and fine sandy loam. The reaction is mildly alkaline or moderately alkaline. This horizon is calcareous.

Shinrock soils are the moderately well drained members of a drainage sequence that includes the very poorly drained Lenawee soils and the somewhat poorly drained Del Rey soils. Shinrock soils are similar to St. Clair, Glynwood, and Lucas soils. They formed in stratified lacustrine sediments. In contrast with St. Clair and Glynwood soils, they do not have glacial pebbles. They are slightly less clayey throughout than the Lucas soils. Shinrock soils have more clay in the subsoil and substratum than the Tuscola variant, which also formed in stratified sediments.

SgB—Shinrock silt loam, 2 to 6 percent slopes. This gently sloping soil occurs as long, moderately wide areas mainly adjacent to escarpments along drainageways.

This soil has a slightly thicker surface layer than is described as representative of the series. Clods are likely to form. The surface crusts after heavy rainfall, which adversely affects stands of seedlings. Runoff is medium.

Included with this soil in mapping are small areas of Del Rey soils on the less sloping parts and spots of Haskins and Rawson soils near the edges of some areas. In a few areas this soil has a loam surface layer.

A moderate erosion hazard is the major limitation for farming. Moderately slow permeability and slope are limitations for some nonfarm uses.

Most areas have been cleared and are used for cultivated crops or pasture. This soil is suited to farming if it is protected from erosion. It has moderate or severe limitations for most recreational and urban developments. Capability unit IIe-2; woodland suitability 2o.

SgC—Shinrock silt loam, 6 to 12 percent slopes. This sloping soil occurs as long, narrow to moderately wide breaks along drainageways. Slopes are short to moderately long. Some areas are slightly eroded.

This soil has the profile described as representative of the series. The surface layer is moderately friable, but cloddiness commonly occurs. Runoff is rapid, and the erosion hazard is severe. Surface crusting is common following heavy rainfall.

Included with this soil in mapping are small areas of Lucas and St. Clair soils and spots of Haney and Rawson soils, commonly near the edge of mapped areas along the St. Joseph River. In a few areas along the St. Joseph River, sandy and gravelly material is in the substratum.

A severe erosion hazard is the main limitation for farming. Slope and moderately slow permeability are limitations for most nonfarm uses.

Most areas have been cleared and are used for cultivated crops and pasture. This soil is moderately well suited to farming if protected from erosion. It has moderate or severe limitations for most recreational and urban developments. Capability unit IIIe-2; woodland suitability 2o.

Shoals Series

The Shoals series consists of nearly level, somewhat poorly drained soils that formed in alluvial deposits. These soils are in low spots on the flood plains. The alluvial sediments washed from nearby uplands.

In a representative profile the surface layer is dark grayish brown loam 8 inches thick. The subsoil, from 8 to 36 inches, is mottled, dark grayish brown, grayish brown, and brown silty clay loam and silt loam. The substratum to a depth of 60 inches is mottled, brown silt loam.

Shoals soils have a deep root zone when drained and a high available water capacity. Permeability is moderate. The soils are saturated for significant periods in winter and spring and dry slowly in spring unless artificially drained. They are subject to flooding, especially during winter and spring.

Shoals soils are well suited to farming if the excess water is removed and if they are protected from flooding. They are well suited to woodland wildlife. Limitations for most nonfarm uses are severe.

Most areas have been cleared and are used for cultivated crops and pasture. A few are wooded.

Representative profile of Shoals loam, in an idle field NW¼NW¼NE¼SW¼ sec. 17, Springfield Township; T. 6 N., R. 4 E., 200 feet west of house and 325 feet south of State Route 34:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; moderate medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

B1—8 to 14 inches; dark grayish brown (10YR 4/2) light silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate coarse angular blocky; firm; common fine roots; thin patchy gray (10YR 5/1) coatings on vertical faces of peds; mildly alkaline; clear wavy boundary.

B21—14 to 25 inches; grayish brown (10YR 5/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate

medium subangular blocky structure parting to moderate medium granular; friable; few fine roots; thin patchy grayish brown (10YR 5/2) coatings on vertical and horizontal faces of peds; neutral; clear smooth boundary.

B22—25 to 36 inches; brown (10YR 5/3) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium granular; friable; few fine (2.5Y 5/2) coatings on vertical and horizontal faces of peds; few fine dark stains; neutral; gradual wavy boundary.

C—36 to 60 inches; brown (10YR 5/3) silt loam; many coarse distinct yellowish brown (10YR 5/6) mottles; massive; firm; grayish brown (10YR 5/2) coatings on cleavage planes; neutral.

The thickness of the solum ranges from 24 to 40 inches.

The Ap horizon is generally 7 to 10 inches thick and is 10YR hue, value of 4 or 5, and chroma of 2. The reaction ranges from slightly acid to mildly alkaline.

The B horizon is 10YR or 2.5Y hue, value of 4 through 6, and chroma of 2 or 3, and it is mottled. The texture is loam, silt loam, light clay loam, or light silty clay loam. Reaction is neutral or mildly alkaline.

The C horizon is 10YR or 2.5Y hue, value of 4 through 6, and chroma of 1 through 3, and it is mottled. The stratified layers include silt loam, loam, and fine sandy loam. In some areas layers of sand and gravel or clayey materials occur below depths of 50 inches. The gravel content ranges from 0 to 20 percent. Reaction ranges from neutral to moderately alkaline. In places this horizon is calcareous.

Shoals soils are the somewhat poorly drained members of a drainage sequence that includes the very poorly drained Sloan soils, the moderately well drained Eel soils, and the well drained Genesee soils. They contain less sand than the Ceresco soils, which lie on similar positions.

Sh—Shoals loam. This nearly level soil occurs as long, fairly wide strips on flood plains and in some places as broad areas covering most of the flood plain. Most areas are readily accessible to farming. A few are isolated. This soil is friable, has good tilth, and is easy to keep in good tilth.

Included with some areas of this soil in mapping are spots of the better drained Eel soils, the sandier Ceresco soils, and the wetter Sloan soils.

Flooding and a seasonal high water table are the major limitations for farming. Poor outlets make drainage difficult to attain in some areas. Seasonal wetness and flooding are limitations for most nonfarm uses.

Most areas are used for cultivated crops and pastures. A few are wooded. This soil is well suited to farming if the excess water is removed and if it is protected from flooding. It has moderate or severe limitations for most recreational and urban developments. Capability unit IIw-2; woodland suitability 2w.

Sloan Series

The Sloan series consists of nearly level, very poorly drained soils that formed in alluvium washed from nearby uplands. They occur throughout the county on flood plains.

In a representative profile the surface layer is very dark gray silty clay loam 11 inches thick. The subsoil, from 11 to 22 inches, is dark gray and dark grayish brown silt loam and silty clay loam with brownish mottles. The substratum, from 22 to 60 inches, is mottled, dark grayish brown and gray silt loam, silty clay loam, and sandy loam.

Sloan soils have a deep root zone when drained and a high available water capacity. Permeability is moderate to moderately slow. These soils are saturated for long periods in winter and spring, and they dry slowly in spring unless adequately drained. Flooding by stream overflow is common during winter and spring, and low areas remain ponded for several days thereafter.

Sloan soils are well suited to farming if the excess water is removed and they are protected from flooding. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Many areas have been cleared and are used for cultivated crops and pasture. The rest are wooded.

Representative profile of Sloan silty clay loam in a pasture field NW¼SE¼NW¼SE¼ sec. 16, Brady Township; T. 7 N., R. 4 E., 170 feet west of field corner post southwest of house:

Ap—0 to 7 inches; very dark gray (10YR 3/1) light silty clay loam; moderate medium granular structure; friable; many fine roots; mildly alkaline; gradual wavy boundary.

A12—7 to 11 inches; very dark gray (10YR 3/1) light silty clay loam, few fine distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; common fine roots; few fine distinct olive (5Y 5/6) stains on faces of peds; neutral; gradual wavy boundary.

B21g—11 to 17 inches; dark gray (10YR 4/1) heavy silt loam; common medium distinct strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; common fine roots; few fine dark concretions; neutral; gradual wavy boundary.

B22g—17 to 22 inches; dark grayish brown (10YR 4/2) light silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; common fine dark concretions; neutral; gradual wavy boundary.

C1g—22 to 27 inches; dark grayish brown (10YR 4/2) silt loam; medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few fine roots; few medium dark concretions; mildly alkaline; gradual wavy boundary.

C2g—27 to 32 inches; gray (10YR 6/1) light silty clay loam; many medium distinct yellowish brown (10YR 5/8) mottles; massive; friable; thick patchy dark

grayish brown (10YR 4/2) coatings on cleavage surfaces; calcareous; moderately alkaline; clear smooth boundary.

IIC3g—32 to 60 inches; gray (10YR 6/1) sandy loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; calcareous; moderately alkaline.

The depth to carbonates and the thickness of the solum range from 20 to 45 inches.

The A horizon is generally 10 to 16 inches thick and is 10YR or 2.5Y hue, value of 2 or 3, and chroma of 1 or 2. The texture is loam or silty clay loam. Reaction ranges from slightly acid to mildly alkaline.

The B horizon is 10YR or 2.5Y hue, value of 4 or 5, and chroma of 1 or 2, and it is mottled. The texture is silty clay loam, clay loam, loam, or silt loam. Reaction ranges from slightly acid to mildly alkaline. In some areas this horizon is calcareous.

The C horizon is 10YR or 2.5Y hue, value of 4 through 6, and chroma of 1 or 2, and it is mottled. The texture is mainly silty clay loam, silt loam, or loam but includes thin layers of sand and gravel or clayey materials. The gravel content ranges from 0 to 25 percent. Reaction ranges from mildly alkaline to moderately alkaline. In some areas this horizon is calcareous.

Sloan soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Shoals soils, the moderately well drained Eel soils, and the well drained Genesee soils. Sloan soils contain less sand than the Cohoctah soils, which also occur on the flood plain.

Sn—Sloan loam. This nearly level soil occurs as long, fairly wide strips on flood plains, and on some tributaries it occupies the entire flood plain. The profile is sandier throughout than the one described as representative of the series. This soil is friable, and it generally has good tilth.

Soil variations are fairly limited in this soil, but small areas of Sloan silty clay loam are included in mapping. Spots of the sandier Cohoctah soil and the better drained Shoals soils are also included in some areas.

Flooding and seasonal wetness are the major limitations for farming and for most nonfarm uses.

Most areas are used for cultivated crops and pasture. A few are wooded. This soil is well suited to farming if the excess water is removed and it is protected from flooding. It has severe limitations for recreational and urban developments. Capability unit IIIw–1; woodland suitability 2w.

So—Sloan silty clay loam. This nearly level soil occurs as long, fairly wide strips or as broader flats on the flood plains. The profile is the one described as representative of the series. The surface layer is moderately friable but tends to be somewhat sticky when wet. Some surface crusting occurs following heavy rainfall.

Included with this soil in mapping are small areas of Sloan loam. Small areas of sandier Cohoctah soils and the better drained Shoals soils are also included.

Flooding and seasonal wetness are the major limitations for farming and for many nonfarm uses.

Many areas have been cleared and are used for cultivated crops and pasture. The rest are wooded. This soil is well suited to farming if the excess water is removed and it is protected from flooding. It has severe limitations for recreational and urban developments. Capability unit IIIw–1; woodland suitability 2w.

Spinks Series

The Spinks series consists of gently sloping to moderately steep, well drained sandy soils. These soils formed in sandy deposits on beach ridges, stream terraces, and moraines. They commonly occur on knolls and ridges.

In a representative profile the surface layer is dark grayish brown fine sand 8 inches thick. Below this, to 130 inches, is yellowish brown and pale brown fine sand banded with dark brown loamy fine sand. The substratum, from 130 to 150 inches, is yellowish brown fine sand.

Spinks soils have a deep root zone and a low available water capacity. They are droughty during prolonged dry periods. Permeability is rapid, but it is moderately rapid in the bands. The soils are subject to soil blowing.

Spinks soils are suited to farming if protected from soil blowing. They are moderately well suited to openland wildlife. Limitations for nonfarm uses range from slight to severe.

Many areas have been cleared and are used for cultivated crops and pasture. The rest are wooded.

Representative profile of Spinks fine sand, 2 to 6 percent slopes, in an idle field NW¼NE¼SW¼NW¼ sec. 23, Northwest Township; T. 9 S., R. 4 W., 100 feet south of fence and 1.25 mile north of Cooney:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sand; weak fine granular structure; very friable; many fine roots; medium acid; abrupt smooth boundary.

A21—8 to 22 inches; yellowish brown (10YR 5/6) fine sand; single grained; very friable; common fine roots; 3 percent fine and medium gravel; medium acid; abrupt wavy boundary.

A22&Bt—22 to 49 inches; pale brown (10YR 6/3) fine sand; single grained; friable; dark brown (7.5YR 4/4) loamy fine sand lamellae ⅛ to ¼ inch thick but in places ranging to ½ inch; lamellae at depths of 22, 26, 28, 30, 32, 36, 42, and 49 inches; medium acid; abrupt wavy boundary.

A23&Bt—49 to 98 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; dark brown (7.5YR 4/4) heavy loamy fine sand lamellae ½ inch to 4 inches thick; lamellae at depths of 54, 60, 64, 68, 75, 81, 87, 91, and 96 inches; clay films bridge sand grains in lamellae; slightly acid; abrupt wavy boundary.

A24—98 to 130 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; neutral.

C—130 to 150 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; calcareous; moderately alkaline.

The depth to carbonates ranges from 45 to 130 inches or more, and the thickness of the solum coincides with these depths in most areas. The gravel

content ranges from 0 to 3 percent, with some pedons having a gravel line in the upper part of the subsoil.

The Ap horizon is generally 6 to 9 inches thick and is 10YR hue, value of 4 or 5, and chroma of 2 or 3. Reaction ranges from medium acid to neutral.

The A2 horizon is 10YR hue, value of 5 or 6, and chroma of 3 through 6. The texture is fine sand or sand. Reaction is mainly medium acid to neutral but is mildly alkaline in the lower layers.

The Bt bands or lamellae are 7.5YR or 10YR hue, value of 4 or 5, and chroma of 3 or 4. The texture is loamy fine sand or loamy sand. Reaction is medium acid to neutral but is mildly alkaline in the lower bands. Lamellae are 1/16 inch to 5 inches thick and have an accumulated thickness of more than 6 inches.

Spinks soils are the well drained members of a drainage sequence that includes the moderately well drained Ottokee soils. They have slightly less clay in the lamellae than the similar Arkport soils.

SpB—Spinks fine sand, 2 to 6 percent slopes. This gently sloping soil is on sandy ridges on beach ridges, stream terraces, and moraines. The profile of this soil is the one described as representative of the series. The soil is very friable and has good tilth. It is droughty and is subject to soil blowing and water erosion.

Included with this soil in mapping are small areas of the moderately well drained Ottokee soils, generally on less sloping spots. Small areas of Oshtemo soils, mainly near the edge of this soil, occur in a few places.

Droughtiness is the major limitation for farming. Soil blowing and water erosion are moderate hazards. The sand content and the hazard of seepage are limitations for some nonfarm uses.

Many areas have been cleared and are used for cultivated crops and pasture. The rest are wooded. This soil is suited to farming if protected from erosion. It has slight to severe limitations for recreational and urban developments. Capability unit IIIs–1; woodland suitability 3s.

SpC—Spinks fine sand, 6 to 18 percent slopes. This sloping to moderately steep soil is on sandy ridges on beach ridges, stream terraces, and moraines. The profile of this soil has a thinner surface layer and a slightly lower available water capacity than that described as representative of the series. Soil blowing is also more severe on this soil because the higher slopes are more exposed to wind action. Surface runoff is rapid, and the hazard of water erosion is severe.

Included in mapping are small areas of Oshtemo soils that are mainly near the edge of this soil.

Soil blowing and water erosion are the major limitations for farming, but droughtiness is also a severe limitation. Slope, sandiness, and the hazard of seepage are limitations for many nonfarm uses.

Many areas have been cleared and are used for cultivated crops and pasture. The rest are wooded. This soil is suited to farming if protected from erosion. It has moderate or severe limitations for most recreational and urban developments. Capability unit IIIe–4; woodland suitability 3s.

Toledo Series

The Toledo series consists of nearly level, very poorly drained clayey soils that formed in lacustrine sediments. These soils occur as broad areas on the lake plain and as narrow strips along small drainageways.

In a representative profile the surface layer is very dark gray silty clay 9 inches thick. The subsoil, from 9 to 44 inches, is mottled, dark gray and gray silty clay. The substratum, from 44 to 52 inches, is gray silty clay and, from 52 to 64 inches, is brown clay loam.

Toledo soils have a deep root zone when drained and a moderate available water capacity. Permeability is slow. The soils are saturated for long periods in winter and spring and dry slowly in spring unless artificially drained. Ponding is common.

Toledo soils are well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Most areas have been cleared and are used for cultivated crops. A few are wooded.

Representative profile of Toledo silty clay in a cultivated field NE¼NE¼SW¼NE¼ sec. 36, Pulaski Township; T. 6 N., R. 3 E., 0.2 mile south of U.S. Route 6, 45 feet west of County Road 1875:

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

B1—9 to 16 inches; dark gray (5Y 4/1) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; very firm; many fine roots; 30 percent of horizon consists of tongues of the A horizon, which extend one-half to full thickness of the horizon; neutral; abrupt irregular boundary.

B21g—16 to 25 inches; dark gray (5Y 4/1) silty clay; common fine distinct brown (10YR 4/3) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; very firm; common fine roots; very dark gray (10YR 3/1) coatings on some vertical faces of peds; neutral; clear smooth boundary.

B22g—25 to 38 inches; gray (5Y 5/1) silty clay; many fine distinct olive brown (2.5Y 4/4) mottles; moderate coarse prismatic structure parting to moderate medium angular blocky; firm; common fine roots; very dark gray (10YR 3/1) coatings on some vertical faces of peds; mildly alkaline; clear smooth boundary.

B23g—38 to 44 inches; gray (5Y 5/1) silty clay; many fine distinct brown (10YR 4/3) and olive brown (2.5Y 4/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few fine roots; very dark gray (10YR 3/1) coatings on some vertical faces of peds; mildly alkaline; gradual wavy boundary.

C1—44 to 52 inches; gray (5Y 5/1) silty clay; many fine distinct olive brown (2.5Y 4/4) and few fine distinct olive gray

(5Y 4/2) mottles; weak thin platy structure with vertical cleavages; gray (N 5/0) coatings on cleavages; calcareous; moderately alkaline.

IIC2—52 to 64 inches; brown (10YR 4/3) clay loam; gray (N 5/0) coatings on vertical cleavages; massive; 5 percent angular stone fragments; calcareous; moderately alkaline.

The depth to carbonates ranges from 36 to 50 inches. The thickness of the solum ranges from 35 to 55 inches.

The A horizon is generally 6 to 10 inches thick and is 10YR or 2.5Y hue, value of 3, and chroma of 1 or 2. The texture is silty clay loam or silty clay. Reaction is slightly acid or neutral.

The B horizon is 10YR to 5Y hue, value of 4 through 6, and chroma of 1 or 2, and it is mottled. The texture is silty clay. Reaction is neutral or mildly alkaline.

The C horizon is 10YR or 5Y hue, value of 4 through 6, and chroma of 1 through 4. The texture is dominantly silty clay but includes clay loam and silty clay loam. Reaction is moderately alkaline. This horizon is calcareous.

Toledo soils are the very poorly drained members of a drainage sequence that includes the somewhat poorly drained Fulton soils, the moderately well drained Lucas soils, and the very poorly drained Bono soils, which have a thicker dark surface layer than Toledo soils. Toledo soils are similar to Latty and Paulding soils but have a darker surface layer. They are also less clayey throughout the profile than Paulding soils. They resemble Lenawee soils but are more clayey throughout. They are similar to Hoytville soils but formed in lacustrine sediments instead of glacial till.

To—Toledo silty clay. This nearly level soil is on the lake plain. It occurs as broad areas and long narrow areas along drainageways. It is subject to surface crusting after heavy rains.

Included with this soil in mapping are areas that have a silty clay loam surface layer. Also included are spots of Del Rey and Fulton soils on slight rises and small areas of Lenawee and Latty soils near the edge of this soil.

Seasonal wetness and clayey textures throughout are the major limitations for farming. Removing excess water is difficult. Drainage installations commonly include both surface and subsurface drains. Seasonal wetness, slow permeability, and clayey textures are limitations for most nonfarm uses of this soil.

Most areas are used for crops. A few are wooded. This soil is well suited to farming if the excess water is removed. It has severe limitations for most recreational and urban developments. Capability unit IIIw-2; woodland suitability 3w.

Tuscola Variant

The Tuscola variant consists of nearly level to sloping, moderately well drained soils formed in stratified deposits of silt, fine sand, and very fine sand. These soils occur adjacent to drainageways and on beach ridges.

In a representative profile the surface layer is dark grayish brown fine sandy loam 9 inches thick. The subsoil, from 9 to 40 inches, is dark yellowish brown and dark brown loam and silt loam that is mottled below 22 inches. The substratum, from 40 to 60 inches, is mottled, light olive brown and light brownish gray silt and very fine sandy loam.

The Tuscola variant has a deep root zone and a high available water capacity. Permeability is moderate to moderately rapid.

These soils are well suited to farming and openland wildlife. Limitations for most nonfarm uses are moderate or severe.

Most areas have been cleared and are used for cultivated crops and pasture. A few are wooded.

Representative profile of Tuscola variant fine sandy loam, 1 to 6 percent slopes, in a cultivated field SW¼ NW¼SE¼NW¼ sec. 16, Brady Township; T. 7 N., R. 4 E., about 500 feet northwest of house:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium angular blocky structure parting to weak medium granular; very friable; many fine roots; few angular coarse fragments; neutral; abrupt smooth boundary.

B1—9 to 13 inches; dark yellowish brown (10YR 4/4) loam; moderate medium and fine angular blocky structure; friable; common fine roots; common medium distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; few angular coarse fragments; slightly acid; abrupt smooth boundary.

B21t—13 to 22 inches; dark brown (7.5YR 4/4) loam; moderate medium angular blocky structure; friable; common fine roots; thin patchy clay films on vertical and horizontal faces of peds; medium acid; clear wavy boundary.

B22t—22 to 31 inches; dark brown (7.5YR 4/4) loam; common medium distinct light brownish gray (2.5Y 6/2) mottles; moderate medium angular blocky structure; friable; common fine roots; thin patchy clay films on vertical and horizontal faces of peds; few fine distinct very dark brown (10YR 2/2) stains; slightly acid; gradual wavy boundary.

IIB23t—31 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; common fine distinct strong brown (7.5YR 5/6) and many medium distinct light brownish gray (2.5Y 6/2) mottles; moderate coarse angular blocky structure; friable; common fine roots; thick continuous brown (7.5YR 5/4) clay films on vertical faces of peds and thick patchy on horizontal faces; few medium distinct very dark brown (10YR 2/2) stains; neutral; clear wavy boundary.

IIC1—40 to 54 inches; light olive brown (2.5Y 5/4) silt; common fine distinct yellowish brown (10YR 5/6) and many medium distinct light brownish gray (2.5Y 6/2) mottles; weak medium platy structure; friable; few fine roots; few fine distinct dark grayish brown (10YR 4/2) streaks

on horizontal faces of peds; calcareous; moderately alkaline; abrupt wavy boundary.

IIIC2—54 to 60 inches; light brownish gray (2.5Y 6/2) very fine sandy loam; few fine distinct strong brown (7.5YR 5/6) mottles; single grained; loose; calcareous; moderately alkaline.

The depth to carbonates and the solum thickness range from 30 to 55 inches.

The Ap horizon ranges from 7 to 10 inches in thickness. It is 10YR hue, value of 4, and chroma of 2 or 3. The reaction ranges from medium acid to neutral.

The B horizon is 10YR or 7.5YR hue, value of 4 or 5, and chroma of 3 or 4, with 2 chroma mottles in the lower part. The texture is sandy loam, sandy clay loam, silt loam, loam, and in places silt. The reaction ranges from medium acid to neutral.

The C horizon is stratified with silt, silt loam, very fine sandy loam, and fine sand. It ranges from 10YR or 2.5Y hue, value of 4 through 6, and chroma of 2 through 4. The reaction is mildly alkaline or moderately alkaline. This horizon is calcareous.

Clay loam, silty clay, or clay glacial till or lacustrine materials occur at depths of 4 to 12 feet.

The Tuscola variant is the moderately well drained member of a drainage sequence that includes the somewhat poorly drained Kibbie soils and the very poorly drained Colwood soils. It has less clay in the subsoil and substratum than Shinrock soils, which also formed in stratified sediments.

TuB—Tuscola variant fine sandy loam, 1 to 6 percent slopes. This nearly level to gently sloping soil commonly is on long slope breaks along drainageways. It is typically on the lake plain, but in some places is on moraines, outwash plains, beach ridges, and stream terraces.

This soil has the profile described as representative of the series. The surface layer has very good tilth, and it is easy to till.

Included with this soil in mapping are areas where the surface layer is loam and small areas of Haney and Rawson soils on beach ridges. Spots of the somewhat poorly drained Kibbie soil are in the less sloping parts of some areas.

A moderate erosion hazard is the major limitation for farming. Seepage areas resulting from the surfacing of laterally moving ground water create hazards for tillage equipment.

Seasonal wetness is a limitation for some nonfarm uses. Capability unit IIe–1; woodland suitability 1o.

TuC—Tuscola variant fine sandy loam, 6 to 12 percent slopes. This sloping soil occupies slope breaks along drainageways on the lake plain. It occurs as long strips. It is easy to till and has good tilth. This soil has a thinner surface layer than is described as representative of the series.

Included with this soil in mapping are areas where the surface layer is loam and a few moderately steep or steep areas. Thin strips of the finer textured Shinrock and Lucas soils commonly occur on the lower parts of slopes.

A severe erosion hazard is the major limitation for farming. Seepage areas resulting from the lateral movement of ground water are hazards for tillage equipment.

Slope and seasonal wetness are limitations for many nonfarm uses. Capability unit IIIe–1; woodland suitability 1o.

Udorthents

Ud—Udorthents. Udorthents are soils that have been disturbed mainly by construction activities. Mixing has destroyed the horizons in these soils. The texture is similar to the underlying material of the other soils in the area. Most soils are loamy or clayey and are calcareous.

The largest areas of Udorthents are along the Ohio Turnpike, railroads, and major roads that cross the county. Borrow pits, some ponded water, and the hard surfaced traffic lanes are included in these areas.

These soils have poor physical properties and should be maintained in permanent vegetative cover. Some areas have good potential for recreation or wildlife developments.

Urban Land

Ur—Urban land. Urban land is made up of built-up areas mainly near the center of towns. Buildings, streets, and parking lots cover most of the soil. The upper soil layers have mostly been disturbed during construction activities. No estimated properties or interpretations are given.

Wallkill Series

The Wallkill series consists of level, very poorly drained soils that formed in alluvial sediments and the underlying organic material. These soils are in shallow depressional areas on moraines, till plains, and flood plains.

In a representative profile the surface layer is very dark grayish brown silt loam 7 inches thick. The subsoil, from 7 to 20 inches, is mottled, dark grayish brown and dark gray silt loam. Below this to 60 inches is very dark gray and dark brown muck.

Wallkill soils have a deep root zone when drained, and a high available water capacity. Permeability is moderate in the mineral layers and moderately rapid to rapid in the underlying muck and peat layers. The soils are saturated most of the year, and ponding occurs during rains.

Wallkill soils are well suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations for most nonfarm uses are severe.

Many areas are used for cultivated crops, but some areas are still in the original bog condition or are cleared and pastured.

Representative profile of Wallkill silt loam, in a pasture field NW¼SW¼SW¼SW¼ sec. 8, Florence Township; T. 7 N., R. 1 E., 86 feet east of County Road 2 and 810 feet north of County Road K:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium and coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21g—7 to 12 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium angular blocky structure; firm; few medium prominent dark reddish brown (2.5YR 3/4) stains; many fine roots; slightly acid; abrupt wavy boundary.

B22g—12 to 18 inches; dark gray (10YR 4/1) silt loam; common fine distinct yellowish brown (10YR 5/4) mottles; moderate medium and coarse angular blocky structure; firm; common medium distinct yellowish red (5YR 4/6) and few fine prominent red (2.5YR 4/8) stains; common fine roots; slightly acid; clear wavy boundary.

B23g—18 to 20 inches; dark gray (10YR 4/1) silt loam; common fine distinct dark brown (7.5YR 4/4) and few fine distinct very dark gray (10YR 3/1) mottles; moderate coarse angular blocky structure parting to moderate medium subangular blocky; friable; common medium distinct yellowish red (5YR 4/6) stains; common fine roots; slightly acid; abrupt smooth boundary.

IIOa1—20 to 23 inches; very dark gray (10YR 3/1), very dark brown (10YR 2/2) rubbed and pressed, sapric material; 30 percent fiber broken; 5 percent rubbed and pressed; massive; friable; common fine prominent dark red (2.5YR 3/6) stains; common fine roots; slightly acid; abrupt smooth boundary.

IIOa2—23 to 60 inches; dark brown (7.5YR 3/2), very dark brown (10YR 2/2) rubbed and pressed, sapric material; 20 percent fiber broken; 5 percent rubbed and pressed in upper part of horizon and 20 percent rubbed and pressed in lower part of horizon; massive; friable; dark reddish brown (5YR 3/4) stains; medium acid; neutral in lower part of horizon.

The mineral soil over the organic material is 16 to 40 inches thick.

The Ap horizon generally ranges from 6 to 10 inches in thickness and is 10YR hue, value of 2 through 4, and chroma of 1 or 2. Reaction ranges from medium acid to neutral.

The B horizon is 10YR to 5Y hue, value of 4 or 5, and chroma of 1 or 2, and it is mottled. The texture is silt loam or silty clay loam. Reaction ranges from medium acid to neutral.

The organic layers are 5YR to 5Y hue or neutral, value of 2 through 4, and chroma of 0 through 3. Reaction ranges from medium acid to neutral.

Silty clay loam, silty clay, or clay loam mineral soil commonly occurs at depths of 5 to 20 feet.

Wallkill soils resemble the very poorly drained Carlisle and Bono soils and the Wallkill variant. Wallkill soils have mineral horizons in the upper part of the profile, which Carlisle soils do not have. They differ from Bono soils in having horizons of organic material in the lower part of the profile. They have less clay in the upper part of the profile than the Wallkill variant.

Wc—Wallkill silt loam. This level soil occurs in oval or long swampy depressions on the Ft. Wayne and Wabash Moraines and on some areas of the till plain. It also occurs in a few places as strips along small drainageways. Some surface crusting occurs after heavy rains.

Included with this soil in mapping are spots of Carlisle and Edwards soils near the center of some areas of this soil. Spots of Pewamo and Sloan soils are included near the edge of this soil. A few areas include spots of Wallkill variant silty clay loam.

Seasonal wetness and ponding are the major limitations for farming. Many areas are difficult to drain because they are depressional.

Seasonal wetness and ponding are also limitations for most nonfarm uses. The organic layers are highly compressible and are subject to subsidence if drained. This is a severe hazard to the use of this soil for buildings and roads. Capability unit IIw-8; woodland suitability 4w.

Wallkill Variant

Wallkill variant consists of level, very poorly drained soils that formed in lacustrine sediments and the underlying organic material. They are mainly in shallow depressional areas on the Ft. Wayne and Wabash Moraines.

In a representative profile the surface layer is dark grayish brown silty clay loam 8 inches thick. The subsoil, from 8 to 32 inches, is mottled, gray and dark gray silty clay. Next, from 32 to 52 inches, is black and dark reddish brown muck. Below this to a depth of 60 inches is olive gray limnic material.

These soils have a deep root zone when drained and a high available water capacity. Permeability is moderately slow to slow in the mineral layers and moderately rapid to rapid in the underlying organic layers. They are saturated for long periods and are subject to occasional ponding.

These soils are suited to farming if the excess water is removed. They are well suited to wetland wildlife. Limitations are severe for most nonfarm uses.

Most areas are used for cultivated crops, but some are still in the original bog condition or are cleared and pastured.

Representative profile of Wallkill variant silty clay loam, in a cultivated field SW¼SW¼SW¼NW¼ sec. 5, Center Township; T. 6 N., R. 2 E., 50 feet east of County Road 8 and 100 feet south of small bridge:

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

B21g—8 to 15 inches; gray (10YR 5/1) silty clay; common medium distinct brown (10YR 4/3) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; plastic; common fine and medium roots along vertical structure breaks; medium acid; clear smooth boundary.

B22g—15 to 20 inches; gray (10YR 5/1) silty

clay; few medium, distinct brown (10YR 4/3) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; plastic; common fine roots along vertical structure breaks; medium acid; clear wavy boundary.

B23g—20 to 24 inches; dark gray (10YR 4/1) silty clay; common medium distinct brown (10YR 4/3) mottles; moderate coarse prismatic structure parting to weak coarse angular blocky; plastic; common fine roots along vertical structure breaks; medium acid; clear wavy boundary.

B24g—24 to 32 inches; dark gray (10YR 4/1) silty clay; common medium distinct brown (10YR 4/3) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; plastic; common fine roots along vertical structure breaks; common medium distinct black (10YR 2/1) stains; thin laminae of black (5YR 2/1) organic material; medium acid; clear wavy boundary.

IIOe1—32 to 35 inches; black (5YR 2/1) sapric material; 10 percent unrubbed, none rubbed; weak thick platy structure; friable; dark gray (10YR 4/1) coatings on faces of peds; very strongly acid; gradual smooth boundary.

IIOe2—35 to 52 inches; dark reddish brown (5YR 3/2) sapric material; 20 percent fiber unrubbed; 3 percent rubbed; weak thick platy structure; friable; very strongly acid in upper part, medium acid in lower part; diffuse wavy boundary.

IIILco—52 to 60 inches; olive gray (5Y 5/2) limnic material; massive; friable; neutral.

The mineral soil over the organic material is 20 to 40 inches thick.

The Ap horizon is 6 to 10 inches thick and is 10YR hue, value of 3 or 4, and chroma of 1 or 2. Reaction ranges from medium acid to neutral.

The B horizon is 10YR to 5Y hue, value of 4 or 5, and chroma of 1 or 2, and it is mottled. The texture is silty clay or clay. Reaction ranges from medium acid to neutral.

The organic layers are mainly sapric but include some limnic materials. They are 5YR to 5Y hue, value of 2 through 5, and chroma of 1 through 3. Mineral soil commonly occurs at depths of 5 to 20 feet.

The Wallkill variant soils are similar to the regular Wallkill soils but have more clay in the upper part of the profile.

Wk—Wallkill variant silty clay loam. This level soil occupies oval or long swampy depressions mainly on the Ft. Wayne and Wabash Moraines. In some places it is adjacent to small drainageways. The surface layer is sticky when wet and is difficult to till. Surface crusting is common following heavy rains.

Small areas of Carlisle soil, mainly near the center of some areas, are included with this soil in mapping. Small areas of Wallkill silt loam and Pewamo and Sloan soils near the edge of this soil are also included.

Seasonal wetness and ponding are the major limitations for farming. Many areas of this soil are difficult to drain because they are depressional.

The seasonal high water table and the hazard of ponding are also limitations for many nonfarm uses. The organic layers are highly compressible and are subject to subsidence if drained. This is a severe hazard to buildings and roads located on this soil. Capability unit IIw–8; woodland suitability 4w.

Formation and Classification of the Soils

This section discusses the factors and some of the processes of soil formation and describes how they have affected the formation of soils in Williams County. It also explains the current system of soil classification and places the soil series in the categories of that system. The soil series in this county and a profile representative of each are described in the section "Descriptions of the Soils."

Factors of Soil Formation

The interaction of five factors of soil formation determines the characteristics of a soil at any given place. These are climate, plants and other living organisms, parent material, relief, and time. Each factor affects the formation of every soil and modifies the effects of the other four. The relative effects of the individual factors vary from place to place.

Climate and vegetation act on the parent material and gradually change it into a natural body of soil. Relief, mainly through its influence on runoff and temperature, modifies the effects of climate and vegetation. The nature of the parent material also affects the kind of soil that is formed. Time is needed to change the parent material into soil. A long period is generally required for distinct soil horizons to develop.

The interaction of these factors is more complex in some soils than in others. In the following pages, the five major factors of soil formation are discussed in relation to their effects on the soils of the survey area.

Climate

Climate has been mainly responsible for determining the character of the vegetation. Because the climate has been relatively uniform for a long enough period, hardwood trees have become the climax vegetation, and percolating water has leached bases and carbonates from most of the soils so that many soils are acid to a moderate depth. The differences in the reaction in the upper 2 feet of most of the soils can be attributed to the differences in the content of carbonates in the parent material. Frequent rains have allowed wetting and drying cycles that were favorable to the downward movement of clay minerals. The Del Rey, Lucas, and Rawson soils, for example, have horizons of clay accumulation in their subsoil. Freezing and thawing help the soil structure to develop in many of the clayey

soils in the county. Warm temperatures in summer have favored biological and chemical reactions in the soils.

Areas of contrasting microclimate in the county are caused by minor differences in relief, but these differences are small.

All soils in Williams County are classified as "mesic" at the family category based on soil temperature. See table 15. The average annual soil temperature at a depth of 20 inches is approximately 2° F higher than the average annual air temperature. The average annual soil temperature in the county ranges from 47° F (8° C) to 59° F (15° C) at a depth of 20 inches.

Plants and animals

Hardwood trees had a dominating influence on soil-forming processes in the county. The better drained upland soils developed under forests that included several species of oak and other hardwood trees. Broad expanses of the lake plain soils and the poorly drained upland soils were formed under swamp forest of mostly elm and ash. These native trees had a relatively low content of bases in their leaves. In undisturbed areas, almost all the soils in the county have a thin surface layer of organic matter and the upper horizons are relatively low in accumulated bases. Thick organic deposits, such as those in the muck soils, occur in depressions where the water table is high for long periods. These soils formed in organic matter, mostly from decaying trees, grass, and sedge plants, that accumulated in saturated conditions.

Other organisms, such as earthworms, fungi, bacteria, rodents, and insects, have contributed to organic residues and to the mixing of materials. These effects should not be minimized, but relatively little is known of their magnitude or consequence in the soil-forming process. Most soils in the county have been mixed by windthrow of trees, particularly in poorly drained areas. In wooded areas of poorly drained soils, a pronounced microrelief of low knolls and depressions is common because of past windthrow. Different species of trees and plants are dominant on the slightly better drained knolls.

Most areas of the original forest have been cleared and used for crops. Man's influence has appreciably changed the soil characteristics in areas affected by erosion or altered by construction work. Extensive drainage projects that have lowered the water table in many areas, additions of lime and fertilizer that have changed the soil chemistry, and tillage that has influenced the structure of the surface layer are examples of how man can greatly modify soil characteristics. These and many other human activities will influence the future development of the affected soils.

Parent material

In Williams County, the main kinds of parent material are (1) glacial till, (2) clayey lacustrine material, (3) glacial lake beach deposits, (4) stream terrace material from glacial outwash, (5) deltaic sediments in the post glacial lake, and (6) recent alluvium. These materials have greatly affected the textures of the various soils in the county.

Direct relationships exist between the major areas of each kind of parent material and the soil associations shown on the general soil map in this survey.

All soil associations in the county have recent deposits of local alluvium along streams. Sloan, Eel, and Genesee soils are examples of soils formed in alluvium. Pewamo, Blount, and Glynwood soils have basic characteristics related to the clay loam glacial till in which they formed. Haskins and Haney soils formed in sandy and gravelly beach deposits. Glacial lake sediment of silty or loamy material is the parent material of Colwood, Kibbie, and Tuscola variant soils. Sandy lake deposits were the materials in which Millgrove and Mermill soils formed, but Roselms, Paulding, Latty, and Fulton soils formed in lacustrine clayey deposits. Small scattered areas of Boyer and Oshtemo soils formed in sandy and gravelly outwash material. Most of the remaining soils formed in mixed parent material and have many characteristics determined by the proportion and sequence of layers of these different materials.

Nearly all of the soils of the county formed in parent materials relatively high in calcium and magnesium carbonates. Subsequent weathering processes have reduced the amount of carbonates now remaining in the surface layer and upper subsoil.

Relief

Relief tends to modify the effects of climate within short horizontal distances. Hillsides, for example, are generally drier than adjacent depressions because water tends to run off the hillside and collect in the depression. Relief largely determines the presence or absence of a seasonal high water table. Almost all the nearly level soils in the county, for example, Blount, Kibbie, and Paulding soils, have a seasonal high water table of varying duration.

Sloping or steep soils tend to be thinner than nearly level soils in the same series. This thinning is caused by rapid surface runoff and erosion. Less percolation and leaching result in less weathering of underlying parent material, resulting in thinner soil.

Drainage sequences of soils that formed in similar parent material are largely the result of differences in relief. Examples are Glynwood, Blount, and Pewamo soils. Glynwood soils are moderately well drained and generally are higher topographically than the other soils in the sequence. Blount soils are somewhat poorly drained and are generally lower in relief than Glynwood soils, but they are not as low as the very poorly drained Pewamo soils.

Areas of both the Wabash and Fort Wayne Moraines have the steepest slopes in the county and the greatest proportion of the better drained soils. The adjacent ground moraines are characterized by gentle slopes. The lake plain in the southeast part of the county is level to nearly level and contains the highest proportion of the more poorly drained soil.

Time

All soils require time for the development of distinct horizons and other characteristics. The length of time a parent material has been in place and exposed to the active forces of vegetation and climate is an important factor in soil formation. The influence of time, how-

TABLE 15.—*Classification of the soils*

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Arkport	Coarse-loamy, mixed, mesic Psammentic Hapludalfs
Belmore	Fine-loamy, mixed, mesic Typic Hapludalfs
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Bono	Fine, illitic, mesic Typic Haplaquolls
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Carlisle	Euic, mesic Typic Medisaprists
Ceresco	Coarse-loamy, mixed, mesic Fluvaquentic Hapludolls
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Colwood	Fine-loamy, mixed, mesic Typic Haplaquolls
Del Rey	Fine, illitic, mesic Aeric Ochraqualfs
Digby	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Edwards	Marly, euic, mesic Limnic Medisaprists
*Eel	Fine-loamy, mixed, nonacid, mesic Aquic Udifluvents
Fulton	Fine, illitic, mesic Aeric Ochraqualfs
*Genesee	Fine-loamy, mixed, nonacid, mesic Typic Udifluvents
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Glynwood	Fine, illitic, mesic Aquic Hapludalfs
Haney	Fine-loamy, mixed, mesic Aquic Hapludalfs
Haskins	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Hoytville	Fine, illitic, mesic Mollic Ochraqualfs
*Kibbie	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Lamson	Coarse-loamy, mixed, nonacid, mesic Aeric Haplaquepts
Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Latty	Fine, illitic, nonacid, mesic Typic Haplaquepts
Lenawee	Fine, mixed, nonacid, mesic Mollic Haplaquepts
Lucas	Fine, illitic, mesic Typic Hapludalfs
[1] Martisco	Fine-silty, carbonatic, mesic Histic Humaquepts
Mermill	Fine-loamy, mixed, mesic Mollic Ochraqualfs
Millgrove	Fine-loamy, mixed, mesic Typic Argiaquolls
Nappanee	Fine, illitic, mesic Aeric Ochraqualfs
Oshtemo	Coarse-loamy, mixed, mesic Typic Hapludalfs
Ottokee	Mixed, mesic Aquic Udipsamments
Paulding	Very-fine, illitic, nonacid, mesic Typic Haplaquepts
Pewamo	Fine, mixed, mesic Typic Argiaquolls
Rawson	Fine-loamy, mixed, mesic Typic Hapludalfs
Rimer	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Roselms	Very-fine, illitic, mesic Aeric Ochraqualfs
Seward	Loamy, mixed, mesic Arenic Hapludalfs
Shinrock	Fine, illitic, mesic Aquic Hapludalfs
Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
St. Clair	Fine, illitic, mesic Typic Hapludalfs
Toledo	Fine, illitic, nonacid, mesic Mollic Haplaquepts
Tuscola variant	Coarse-silty, mixed, mesic Aquic Hapludalfs
Udorthents	Udorthents; loamy
Wallkill	Fine-loamy, mixed, nonacid, mesic Thapto-Histic Fluvaquents
Wallkill variant	Fine, mixed, mesic Thapto-Histic Fluvaquents

[1] This series has a proposed classification change to Fine-silty, carbonatic, mesic Histic Limnaquents.

ever, is greatly modified by other soil-forming factors, such as relief and parent material.

The glacial till that now forms the land surface of about two-thirds of Williams County has been exposed to the other soil-forming factors since the retreat of the last glacier about 13,000 years ago. The lake plain soils in the southeast part of the county have formed since the recession of the various lake levels 9,000 to 12,000 years ago.

The soils on the sandy and gravelly beach ridge deposits also formed during the same period. Most of the parent materials of the soils, except the recent alluvium, have had an equal period of time for soil formation. The obvious differences in rates of soil formation are caused by differences of parent material, topography, or other soil-forming factors. On the flood plains, soils such as Shoals, Sloan, and Genesee are periodically flooded and the deposition of new sediments prevents the development of distinct profiles. Profile development is also slight in the Spinks, Ottokee, and other sandy soils. The quartz sands are highly resistant to physical and chemical change.

Geologically, the soils of Williams County have been developing for a relatively short time. This accounts for the shallowness of leaching and the slightly acid or neutral reaction common in many of the soils.

Processes of Soil Formation

The factors of soil formation discussed in previous sections largely control or influence four soil forming

processes. These are additions, losses, transfers, and alterations (*12*). Some of these processes promote differences within a soil, and others retard or preclude differences. The differentiation of horizons in the soils of Williams County results from one or more of these processes. Although they have taken place in some soils or are beginning to take place in others, the degree of their expression varies from soil to soil.

Additions—The most obvious addition is the accumulation of organic matter in the surface layer of the soils. Others are the addition of bases in organic matter and in ground water, addition of bases in lime and fertilizer, and deposition through erosion. The dark colored surface layer in the Hoytville, Toledo, Millgrove, and Colwood soils is an example of the addition of organic matter. All the soils in the county have some organic-matter accumulation, but in areas where the accumulation was originally thin, plowing and cultivating have largely destroyed or incorporated it with other horizons. The Nappanee, St. Clair, Fulton, and Lucas soils, for example, show a limited addition of organic matter.

Plant nutrients are recycled from soil to plant and back to the soil again in the form of litter or organic material. This process occurs in all the soils. Soils that are seasonally waterlogged, such as Millgrove and Colwood, continually accumulate bases through additions from the ground water. The additions of bases are generally greater than the losses in these soils. Soils such as Genesee and Shoal periodically receive additions of soil materials deposited by floodwater. The applications of lime and fertilizer on cropland and areas of pasture counteract the normal occurrence of plant nutrient loss. Where applications are heavy, nutrient gains may exceed nutrient losses.

Losses—Soil losses occur from the removal of bases by leaching, from the removal of plant nutrients by crops, from actual losses through erosion, and from volatilization. One of the most significant losses in Williams County is the leaching of carbonates. Most finer textured, light colored soils on uplands have carbonates removed to a depth of 20 to 35 inches. This loss of carbonates is considerable because the glacial till or lacustrine clays ranged from 15 to 25 percent calcium carbonate prior to weathering. The coarser textured soils generally are leached to greater depths, ranging from 4 to 9 feet. Examples are soils of the Ottokee and Spinks series. Carbonate loss precedes other chemical changes in the solum, and the total removal is slower in those materials that are high in content of carbonate. Other minerals are subject to the same chemical weathering and are also lost through leaching but at slower rates.

Transfers—The most significant transfers in the soils of Williams County involve transfers of colloidal material from the surface layer or the A horizon to greater depths. The primary minerals are transformed to silicate clay minerals largely by the processes of hydrolysis and base substitution. Most of the clay remains in the soil profile, but much of the fine clay is transferred from the A horizon to deeper horizons. It is carried downward by percolating water and is deposited as clay films on the surfaces of soil peds, in cracks, and in root and earthworm channels. Clay films are observable in Del Rey, Haskins, Nappanee, Fulton, and other soils.

The translocation and in-place development of these silicate clay minerals has had a strong influence on the horizon development in about half of the soils in Williams County. Various sesquioxides have also been transferred from the surface layer to lower layers by this weathering process.

Alterations—The reduction and solution of ferrous iron has taken place in the very poorly drained and somewhat poorly drained soils. This reduction of iron, called gleying, is evident in Hoytville, Toledo, Millgrove, Colwood, and Latty soils because of a recurring water table. Gray colored soil indicates a condition favorable to the reduction process. Reduced iron is soluble, but in Williams County it has commonly been moved only a short distance and either stops in the horizon where it originated or in an underlying one. Part of this iron may be reoxidized and segregated to form the commonly observed bright colored, yellow and red mottles. Mottling, observed in all but the well drained soils, is caused by this alteration of iron in the soil and is the result of a fluctuating water table. Accumulations of iron and manganese are common in somewhat poorly drained and very poorly drained soils. They occur as dark brown or black blotches on ped surfaces or as small, shotlike concretions.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as the soil series, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification used by the National Cooperative Soil Survey (*16*) has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped together. In table 15, the soils of the survey area are classified according to the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (In-cept-i-sol).

SUBORDER. Each order is divided into suborders that are based primarily on those soil characteristics that seem to produce classes having the greatest

genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. Each suborder is identified by a word of two syllables. The last syllable indicates the order. An example is *Aquept* (*Aqu*, meaning water or wet, and *ept*, from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and those that have dark colored surface horizons. The features used are the self-mulching properties of clay, the temperature, the major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the dark red and dark brown colors associated with basic rocks. Each great group is identified by a word of three or four syllables; a prefix is added to the name of the suborder. An example is Haplaquepts (*Hapl*, meaning simple horizons, *aqu* for wetness or water, and *ept*, from Inceptisol).

SUBGROUP. Each great group is divided into subgroups, one representing the central, or typic, segment of the group and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. Each subgroup is identified by the name of the great group preceded by one or more adjectives. An example is Typic Haplaquepts (a typical Haplaquept).

FAMILY. Soil families are established within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineral content, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name is the subgroup name preceded by a series of adjectives, class names for texture and mineralogy, for example, that are used as family differentiae. An example is the Typic Haplaquepts, fine, illitic, nonacid, mesic.

SERIES. A series is a group of soils that have major horizons that, except for texture of surface layer, are similar in important characteristics and in arrangement in the profile.

General Nature of the County

This section provides general information about Williams County. It discusses settlement, geology, relief, water resources, climate, natural vegetation, transportation facilities, school facilities, and farming.

Settlement

Williams County is in the northwestern corner of Ohio adjacent to Indiana and Michigan. The county is part of the Congress Lands of 1820 and 1821 and originally included parts of what later became Defiance and Fulton Counties. Settlement of the Ohio-Michigan boundary dispute in the 1830's added a northern tier of townships to the county.

Many Indian tribes preceded explorers and French trappers into this area. They traveled the St. Joseph and Tiffin Rivers and the beach ridges along parts of present U.S. Route 127 and State Route 2. The Miami, Wyandot, Ottawa, Potawatomi, and Chippewa Indians left many relics near their campsites and along their trails. Recently restored mounds near Nettle Lake in the northwestern part of the county show an ancient Hopewell Indian culture.

Earlier settlers in the 1820's and 1830's used old Indian cornfields on the river bottoms for crops as they girdled and cleared trees in this once heavily forested wilderness. Drainage of the Black Swamp or lake plain in the southeastern part of the county started in the mid-1800's and has continued to the present through the use of open ditches and systematic tiling. Most of the land acreage of Williams County is currently used for farming.

Geology

Williams County soils are all post-glacial in origin. The dominant features of the glacial landscape are the Wabash and Ft. Wayne Moraines and the Maumee Lake Plain (*7*).

The Wabash Moraine occupies most of Northwest Township and parts of Bridgewater and Florence Townships. The ground moraine east of the Wabash Moraine is about 6 to 8 miles wide, extending in a northeast-southwest band between Edgerton and Pioneer and paralleling the St. Joseph River. The Fort Wayne Moraine lies in about a 5-mile wide belt, just east of and parallel to the St. Joseph River, with the hamlets of Melbern, West Jefferson, and Kunkle along its crest. The ground moraine east of the Fort Wayne Moraine extends northeastward from Bryan through West Unity. Most of Springfield, Brady, and Pulaski townships are within the Maumee Lake Plain part of the county. Bean Creek and Brush Creek, branches of the Tiffin River, drain the relatively flat lake plain area.

Lacustrine and glacial materials that are commonly about 75 to 250 feet thick overlie the bedrock. The bedrock surface is very uneven.

The bedrock that is encountered first is the Cuyahoga Shale member of the Mississippian Formation. It is about 300 to 400 feet thick (*10*).

The glacial material contains relatively thick layers of sand and gravel. These porous layers provide a source of water for wells. The till under the lake plain part of the county averages about 100 feet thick and contains less strata of sand and gravel than in other parts of the county. Consequently, this area has poorer sources of ground water (*17*).

The ground moraine east of the Ft. Wayne Moraine is bordered on the east side by a beach ridge that extends along its entire length (*7*). Sandy soils dominate the beach ridge. Soils having sandy upper layers extend east of this ridge, but they progressively contain

less sand as they merge with the clayey soils in the lake plain.

Sources of gravel and sand are along the St. Joseph River. Mining sites near Montpelier and Edgerton have been developed to provide a variety of building-trade products. Some of the sand is used in the production of cement. Commercial use has been made of smaller deposits of beach ridge sand in a limited number of places.

Scattered areas of organic soils have economic potential for the sale of either their organic constituents or the underlying layers of marl with a high calcium carbonate content.

Relief

The surface slope in Williams County changes from rolling to flat topography from northwest to southeast. The highest point in the county is in the northwest corner next to Michigan and Indiana, and the lowest point is along the Tiffin River at Lockport.

The rolling topography of this county was caused by material being pushed together by the glacier during the ice age. The more rolling relief is on the Wabash and Ft. Wayne end moraines that formed when the ice front remained stationary for a period of time. The ground moraine areas are less rolling and illustrate the retreat of the glacier at a relatively uniform rate (*8*).

The flat area in the southeastern part of the county formed in various stages of glacial lakes. Large relatively uniform lacustrine deposits and local lake bottom sorting are characteristic of the materials in which the soil formed. This flat area is broken only by the drainage pattern of the Tiffin River. Short, steep slopes occur along this river and its tributaries.

Water Resources

Observation of both aerial photographs and topographic maps shows numerous water areas in the county. The most important and largest are Nettle Lake, Lake La Suan, Lake Seneca, and Mud Lake. There are many smaller bodies of water throughout the county. Lakes in the county cover about 420 acres. There are also some impoundments, which serve as reservoir storage for the towns and villages. There is a total of about 350 acres of farm ponds and about 620 acres of open water along the St. Joseph and Tiffin Rivers. Tributary streams and numerous ditches in the county add many more acres of open water. All these water areas have a profound effect on the ground water recharge, on maintaining the humidity of the air, and on the drainage for all purposes. They are also a source of water for a few irrigation projects. Some of the principal uses of surface water include drinking water and fire protection for towns and villages. Both upland and wetland wildlife populations are related to the availability of surface water.

The Divisions of Water and Geological Survey of the Ohio Department of Natural Resources have made studies of the underground water supply (*17*). Most water sources are identified as seams or strata of sands and gravel in the glacial material. The underlying shale bedrock is not commonly a good source of water. Water production varies widely from place to place. From a large number of well logs, one can generalize that in the area west of a line connecting Bryan and West Unity, the characteristics of the glacial till are such that 500-gallon-per-minute wells can be developed. In some places up to 1,000 gallons per minute can be obtained.

A belt of artesian wells is on both sides of the Tiffin River and on the beach ridge between Bryan and West Unity. Their capacity is also about 500 to 1,000 gallons per minute.

In the lake plain or southeastern part of the county, well logs indicate that yields of 100 gallons per minute can be developed. The water-bearing seams of sand and gravel are thinner and are more infrequent than in other parts of the county.

Most of the water in the county has varying degrees of hardness and may contain some iron.

Climate

The climate of Williams County is classified as continental (*14*). Such a climate is characteristic of a land mass the size of North America and is marked by large annual, daily, and day-to-day ranges of temperature. Summers are moderately warm and humid with an average of 18 days with temperatures of 90° F or higher. Winters are reasonably cold and cloudy with an average of 4 days with subzero temperatures. Weather changes occur every few days, with subzero temperatures, as a result of the passing of cold or warm fronts and their associated centers of high and low pressure.

Temperature and precipitation data recorded at Montpelier, Ohio, from 1936 to 1965 is used to represent all of Williams County. During this period the average annual temperature was 50.3° F. The average monthly temperatures were in the 60's and 70's during the summer and 20's and 30's during the winter. They ranged from a high of 73.4° in July to a low of 25.6° in January.

The average annual precipitation is 33.13 inches. June has the highest average precipitation of 3.73 inches. December has the lowest at 1.88 inches. April through August have an average of between 3 and 4 inches of precipitation per month.

Precipitation in the form of snow and sleet averages 22.7 inches per year. Most snow falls during the months of December, January, and February.

Showers and thunderstorms account for most of the rainfall during the growing season. Thunderstorms occur about 42 days each year, mostly from April through August. A high percentage of the soil erosion on agricultural land occurs during this period. Evaporation is greatest during the warm months and when moisture is most critical for agriculture. In May through September, potential evaporation normally exceeds rainfall by 10 inches. Surface windspeed averages about 8 miles per hour in winter. Damaging winds occur most often in spring and summer and are usually associated with migrating thunderstorms. Since 1900, five tornadoes have been reported in Williams County.

The amount of moisture in the soil is related to rainfall and commonly varies from season to season in a

pattern that often repeats itself annually. It reaches its lowest point in October and is replenished late in winter and early in spring when precipitation exceeds evaporation and water used by vegetation.

To achieve high yields of most field crops, a large amount of available water is needed in the root zone of the soil, particularly in July and August. Available water is mainly that water retained in the soil after natural or artificial drainage has taken place. In July and August, however, the amount of rainfall is slightly less per month than in the prior months of the growing season. Its distribution in some years is also not uniform; therefore, the success of a crop often depends on the reserve of available water in the root zone during the drier months of the growing season. The amount of this reserve, both at the beginning and throughout the season, depends on the available water capacity of each kind of soil and on the extent to which soil and water conservation practices have been used.

The length of the average growing season in the county is 157 days. This period is related to the dates of May 2 to October 6. The date of the last freezing temperature in the spring can be expected later than May 17, 1 year in 10; later than May 8, 3 years in 10; and later than May 2, 5 years in 10. The first freezing temperature in the fall can be expected earlier than September 21, 1 year in 10; earlier than September 30, 3 years in 10; and earlier than October 6, 5 years in 10.

Some kinds of soil in the county warm up earlier in spring and are more suited to early planting of crops than others. The rate by which the temperature of the soil increases in the spring is related to the amount of water in the soil. It takes more heat to increase the temperature of water in the soil than to increase that of the mineral or organic components; therefore, good drainage, either natural or artificial, is necessary for early spring planting.

The maximum depth of soil freezing during the winter months varies. Generally, soil bare of vegetative cover can freeze to approximately 30 to 36 inches depth. Factors such as degree of coldness and the duration of a period of cold weather are related to the depth of frost penetration. Conversely, the amount of water in the soil and the vegetative cover are moderating factors.

Frost heaving occurs under a specific combination of conditions that are related to freezing soil temperature and the presence of water in the soil. Frost heaving can damage the root system of a plant as well as crumble a hard surface road. Those soils with a relatively high silt content and a water table within a few feet of the surface are most susceptible to the ice build-up associated with frost heaving. The combination of temperature and moisture conditions favorable for frost heaving commonly occurs in winter and early spring. Vegetative cover or snow cover, or both, moderate the effect of heaving.

The drying of soil after a period of rain crusts the surface of most soils in the county. Crusting is most common on those soils that have a silt loam or finer texture and are unprotected from the puddling effect of rain. The impact of rain and the consolidating effect of the water on the soil particles causes crusting when the surface dries. The crust commonly is about ½ inch to 1½ inches thick. Crusting is less of a problem on soils that have surface layers that are either high in organic matter or in sand content.

Conditions conducive to crusting may occur at any time, but the effect of crusting is most critical at the time of seedling emergence. A surface crust will also reduce infiltration and increase runoff.

Natural Vegetation

The natural vegetation at the time of the earliest land surveys in the county consisted of deciduous forest. This forest can be subdivided into two major vegetation types, the Beech Forest and the Elm-Ash Swamp Forest (*9*).

The Beech Forest is associated with a wide variety of soil conditions and was therefore distributed rather uniformly throughout about 85 percent of the county. This forest is characterized by beech, sugar maple, northern red oak, white ash, and white oak, with scattered basswood, shagbark hickory, and black cherry. Most species could tolerate seasonal wetness.

The Elm-Ash Swamp Forest was associated with relatively large, but uniform, areas of wet soils. These areas were commonly wet for an extended period from early winter through midsummer. This forest type was scattered throughout the county in areas interadjacent to the predominating Beech Forest type. Areas range from about 1 to 12 square miles each. The dominant trees of the canopy were American elm and several species of ash and maple and cottonwood and sycamore in extremely wet areas.

There are many small, extremely wet areas in the county. Most range from 1 to 25 acres in size. The soils are mostly associated with flood plains or muck pockets. They are extremely wet or periodically submerged with fresh water. The vegetation was marsh grass, reeds, and associated species, which are well suited to wetland wildlife environment.

Transportation Facilities

The highways in the county consist of a network of all-weather roads. These include Township, County, State, and Federal highways and one interstate turnpike. Nearly all of the roads in the county, except for a few township roads, are blacktopped. Four Federal highways are major traffic arteries across the county. These are U.S. Routes 6, 20, alternate 20, and 127. The Ohio Turnpike crosses the county in an east-west direction with an interchange south of Pioneer at State Route 15. Several State highways provide good traffic links for all parts of the county. Communities in all areas are well serviced by interconnecting county and township roads.

Several major railroads, including the Penn Central and the Norfolk and Western, cross the county. There is a private airport for public use at Montpelier and a county airport with paved runway at Bryan.

School Facilities

There are many public schools and several parochial schools in the county. Additional school buildings are being planned. There is a four-county joint vocational school at Ridgeville Corners in adjoining Henry

County. Bowling Green State University has a branch there. There are no colleges or universities in the county, but many are close by. These include Defiance College, Bowling Green State University, Toledo State University, Hillsdale College in Michigan, and Tri-State College at Angola, Ind. Other college and technological schools are in Fort Wayne, Ind., and Toledo, Ohio.

Farming

Farming is one of the principal industries in Williams County. In 1969 the Census of Agriculture reported 238,628 acres in farms, or about 89 percent of the total land area of the county. More than 10 percent of the work force is directly engaged in the production of agricultural products, such as dairy products, beef, hogs, poultry, cash grain, and some special crops, including tomatoes.

The trend from 1964 to 1969 showed a slight increase in the number of farms and a very slight decrease in their average size. There was an increase in the number of farms less than 100 acres and more than 500 acres. The number of part time farms also increased. There was a slight decrease in the number of acres of woodland and pasture but a 10 percent increase in harvested cropland.

The acreage of all crops but soybeans decreased between 1964 and 1969. The number of livestock also decreased for all kinds but sheep and lambs. Numerous farms, particularly in the lake plain area, have no livestock.

In 1969 there were 43,455 acres of corn, 18,034 acres of wheat, 53,624 acres of soybeans, and 14,359 acres of hay. The livestock included 25,399 cattle and calves, 9,045 sheep and lambs, 35,093 hogs and pigs, and 132,880 chickens.

Farm-related business includes tomato-processing plants at Bryan and Blakeslee and several egg-packaging plants at West Unity. Grain elevators and suppliers of farm-related goods and services are available throughout the county.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Beach ridge. Ridge that was formed by wave or wind action on the beach of an ancient glacial lake and that remains after the glacial lake dried up.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

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 40 or 80 inches (1 or 2 meters).

Coprogenous earth (sedimentary peat). Organic and inorganic materials either deposited in water by precipitation or by action of aquatic organisms such as algae or diatoms, or derived from underwater and floating aquatic plants subsequently modified by aquatic animals.

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. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Delta. An alluvial deposit, commonly triangular in shape, formed largely beneath water and deposited at the mouth of a river or stream.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geological processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. None means that flooding is not probable; rare that it is unlikely but possible under unusual weather conditions; 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. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The 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 assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, unstratified 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.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

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 from 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, which is the upper limit of saturation.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

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. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Marl. An earthy, unconsolidated deposit formed by freshwater lakes that consists chiefly of calcium carbonate mixed with various amounts of clay or other impurities.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral and low in organic material. Its bulk density is greater than that of organic soil.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy 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. Types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three single 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.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is comonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A land form of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

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 a semisolid to a plastic state.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Rooting depth. Shallow root zone. See Root zone..

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

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 horizonal. Percentage of slope is the vertical distance divided by horizonal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizonal distance.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: very coarse sand (2.0 millimeters to 1.0 millimeter); coarse sand (1.0 to 0.5 millimeter); medium sand (0.5 to 0.25 millimeter); fine sand (0.25 to 0.10 millimeter); very fine sand (0.10 to 0.05 millimeter); silt (0.005 to 0.002 millimeter); and clay (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

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 soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use of management.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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