United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Purdue University Agricultural Experiment Station and the Indiana Department of Natural Resources, State Soil Conservation Board and Division of Soil Conservation

Soil Survey of Tippecanoe County, Indiana

How To Use This Soil Survey

General Soil Map

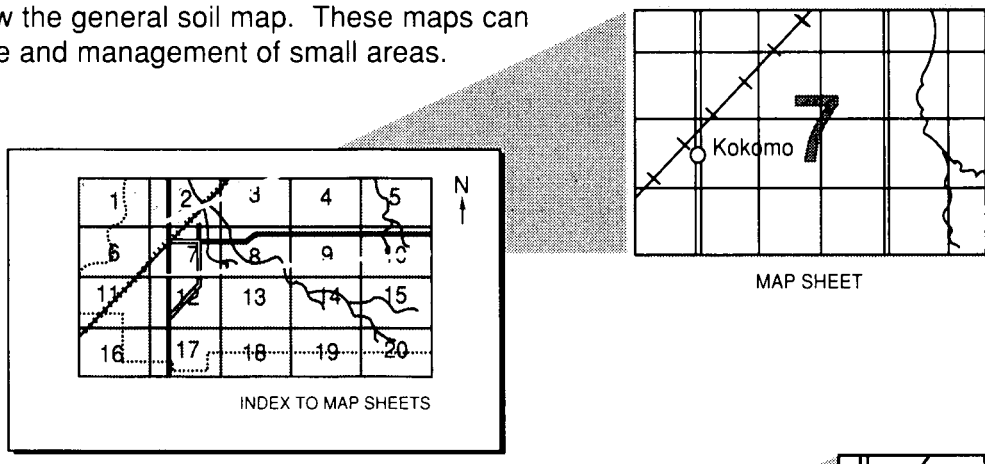
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

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

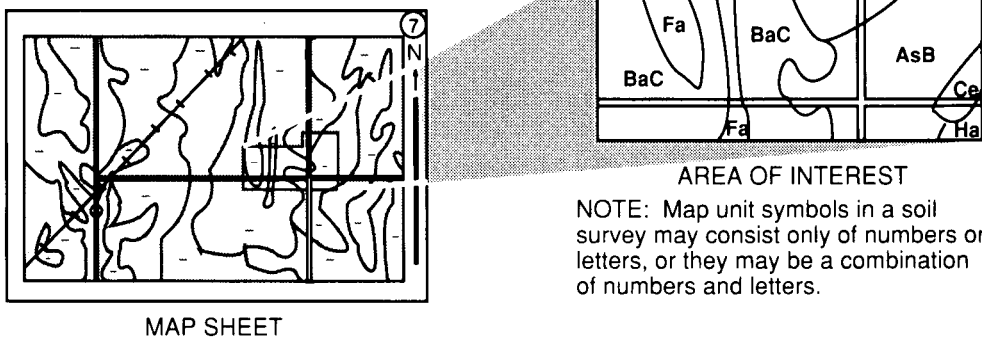
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

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



MAP SHEET

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed during the period from 1983 to 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Natural Resources Conservation Service, the Purdue University Agricultural Experiment Station, and the Indiana Department of Natural Resources, State Soil Conservation Board and Division of Soil Conservation. It is part of the technical assistance furnished to the Tippecanoe County Soil and Water Conservation District. Financial assistance was provided by the Board of County Commissioners of Tippecanoe County.

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

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call 1-800-245-6340 (voice) or (202) 720-1127 (TDD). USDA is an equal employment opportunity employer.

Cover: Corn in an area of Mahalasville silty clay loam, gravelly substratum, and alfalfa in an area of Desker sandy loam, kame, 6 to 12 percent slopes, eroded.

Contents

Issued 1998

Index to Map Units

Summary of Tables

Foreword

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

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

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

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

Robert L. Eddleman
State Conservationist
Natural Resources Conservation Service

Soil Survey of Tippecanoe County, Indiana

By Thomas R. Ziegler, Natural Resources Conservation Service, and Douglas R. Wolf, Division of Soil Conservation, Indiana Department of Natural Resources

Fieldwork by Thomas R. Ziegler, Robert C. Wingard, Jr., Kendall M. McWilliams, and Earnest L. Jensen, Natural Resources Conservation Service; Douglas R. Wolf, Mark S. McClain, Randy J. Braun, Edwin A. Taylor, and Larry Osterholz, Division of Soil Conservation, Indiana Department of Natural Resources; and Michael H. Ebinger, Purdue University

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
Purdue University Agricultural Experiment Station and the Indiana Department of Natural Resources, State Soil Conservation Board and Division of Soil Conservation

TIPPECANOE COUNTY is in west-central Indiana (fig. 1). It has a land area of 322,000 acres, or 503 square miles. The county extends about 24 miles from north to south and 21 miles from west to east. Lafayette, the county seat, is in the central part of the county. The population of Tippecanoe County is about 122,000.

About 81 percent of the county is farmed. Grain is the principal crop. Hogs, beef cattle, sheep, and a few dairy cattle are raised in the county, and the county has a few truck farms. Because of urban and industrial development, the acreage of farmland is continually decreasing.

This survey updates the soil survey of Tippecanoe County published in 1959 (Ulrich and others, 1959). It provides additional information and has larger maps, which show the soils in greater detail.

General Nature of the County

This section provides some general information about Tippecanoe County. It describes climate; history; physiography, relief, and drainage; water supply; and transportation facilities and industries.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Lafayette, Indiana, in the period 1961 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 26 degrees F and the average daily minimum temperature is 17 degrees. The lowest temperature on record, which occurred at Lafayette on December 22, 1989, is -25 degrees. In summer, the average temperature is 72 degrees and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred at Lafayette on July 15, 1954, is 106 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 36.03 inches. Of this, 21.57 inches, or about 60 percent, usually falls in April

Figure 1.—Location of Tippecanoe County in Indiana.

through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 4.14 inches at Lafayette on May 26, 1989. Thunderstorms occur on about 43 days each year, and most occur in July.

The average seasonal snowfall is 22.4 inches. The greatest snow depth at any one time during the period of record was 17 inches. On the average, 37 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 62 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 67 percent of the time possible in summer and 43 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 11.7 miles per hour, in March.

History

The first European settlement in Indiana was established in 1717 at Fort Ouiatenon, 4 miles south of Lafayette on the Wabash River. This fort was built by the French to protect traders and trappers. The English captured the fort in 1763 and again in 1779 during the American Revolution. In 1791, the fort was destroyed. In 1811, the Battle of Tippecanoe was fought at Battle Ground. In this battle, General William Henry Harrison and his small army defeated a group of Indians led by the Prophet, brother of Tecumseh.

The first permanent settlers came to the survey area in 1822. Lafayette was laid out in 1825. It was named for the French general, the Marquis de Lafayette. Tippecanoe County was established in 1826. West Lafayette was first established in 1845 as the village of Kingston. It was renamed Chauncey and was finally named West Lafayette in 1888.

The Wabash and Erie Canal was constructed during the 1830's and 1840's. The canal reached Lafayette in 1843. The first railroad reached Tippecanoe County in 1851.

Physiography, Relief, and Drainage

Tippecanoe County is mainly a flat plain dissected by the Wabash River and by numerous other rivers, creeks, streams, and ditches (fig. 2). Glaciation was the principal factor affecting the present landforms. The area was completely covered by ice of the Wisconsinan glacial period. As the ice receded to the north, meltwaters flowed across the county and formed terraces and outwash plains along the Wabash River and its tributaries.

The underlying bedrock in the western part of the county is Mississippian age siltstone and shale, and that in the northeastern part of the county is New Albany shale of Devonian age. The bedrock is exposed in many locations along Flint Creek in the western part of the county and along the Wabash River in the northeastern part.

The greatest relief in the county is along the Wabash River and its tributaries, along the breaks between the uplands and the terraces and flood plains. The highest elevation, about 840 feet above sea level, is near Clarks Hill in the southeastern part of the county. The lowest elevation, about 495 feet above sea level, is at the point where the Wabash River leaves the county, at the western edge.

The Wabash River cuts diagonally across the northern half of the county from northeast to southwest.

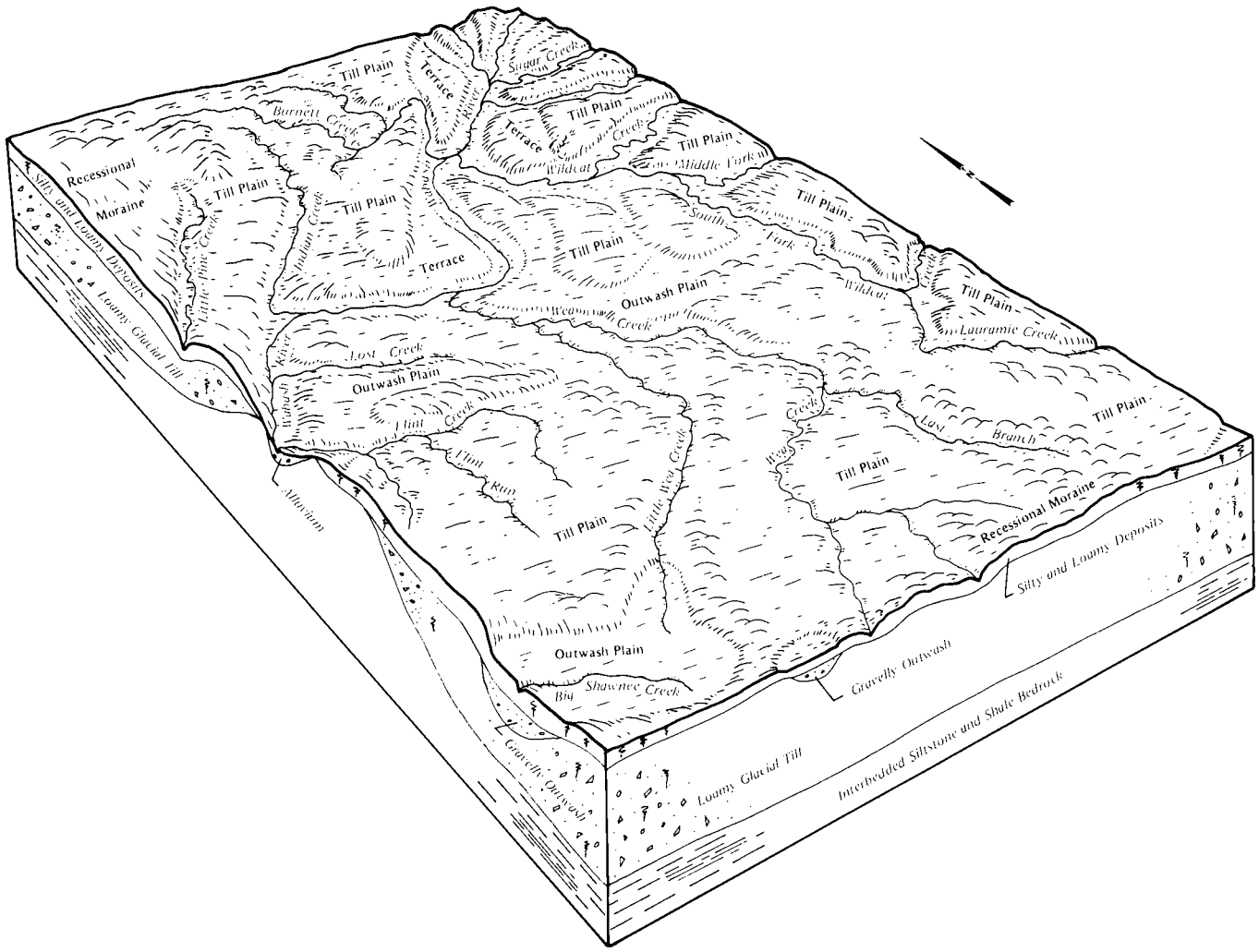


Figure 2.—Physiography and drainage in Tippecanoe County, Indiana.

This river and its tributaries drain all of the county.

The Wabash River is bordered by valleys ranging from ½ mile to 5 miles in width. The valleys associated with its major tributaries range from about 50 feet to ½ mile in width. Bottom-land areas near the mouth of these tributaries are commonly flooded several times in late winter and early spring.

Water Supply

Most of the water for domestic and industrial uses comes from wells. Wells along the Wabash River are in areas of gravelly outwash. These wells serve most of Lafayette, West Lafayette, and numerous industries.

Transportation Facilities and Industries

Interstate 65 and U.S. Highway 52 run diagonally through Tippecanoe County from southeast to northwest. U.S. Highway 231 runs from south to north. Several State highways also cross the county in various directions.

The county has two airports. Two bus lines accommodate travel from the county to various other destinations, and an intra-city public bus line provides service for Lafayette and West Lafayette. Several rail lines cross the county, one of which offers public transportation.

Lafayette and West Lafayette have many industries, and several small industries are in other areas of the

county. Various items are manufactured, including chemicals, automobiles, food-related products, machine and auto parts, and electronic components. Most of the workforce is employed within the county.

How This Survey Was Made

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

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

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

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

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

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

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

Some of the names, descriptions, and delineations of the soils on the soil maps of this survey area do not fully agree with those on the maps of surveys of adjacent counties, which were published at different dates. The differences are the result of changes in series concepts, variations in the intensity of mapping or in the extent of the soils within the survey area, or local decisions regarding ranges used for slope classes.

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

Soil Descriptions

Very Poorly Drained, Poorly Drained, Somewhat Poorly Drained, and Well Drained, Medium Textured and Moderately Fine Textured, Nearly Level and Gently Sloping Soils; On Glacial Till Plains

These map units are made up mostly of soils that have a seasonal high water table. These soils make up about 58 percent of the county. Most areas are drained and are used for corn, soybeans, or small grain. Some areas are used for hay and pasture or as woodland. The soils are well suited to row crops. They generally have severe limitations affecting sanitary facilities and building site development.

1. Drummer-Toronto-Millbrook

Nearly level, poorly drained and somewhat poorly drained soils that formed in silty material and in the underlying glacial till or glaciofluvial deposits; on till plains

This map unit is in broad depressional areas and slight rises on glacial till plains characterized by swale-and-swell topography and very little relief. Slopes range from 0 to 2 percent.

This map unit makes up about 27 percent of the county. It is about 35 percent Drummer soils, 15 percent Toronto soils, 11 percent Millbrook soils, and 39 percent soils of minor extent (fig. 3).

Drummer soils are poorly drained and are in depressional areas. Some of the Drummer soils have a stratified sandy substratum. Typically, the surface layer of the Drummer soils that do not have a stratified sandy substratum is black silty clay loam. The subsoil is black, grayish brown, light brownish gray, and yellowish brown, mottled silty clay loam, silt loam, and clay loam. Typically, the surface layer of the Drummer soils that have a stratified sandy substratum is black silty clay loam. The subsoil is dark gray and olive gray, mottled silty clay loam and sandy loam.

Toronto soils are somewhat poorly drained and are on slight rises. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of dark brown, dark yellowish brown, and yellowish brown, mottled silt loam, silty clay loam, silty clay, clay loam, and loam.

Millbrook soils are somewhat poorly drained and are on slight rises. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of light olive brown and yellowish brown, mottled silty clay loam, loam, loamy sand, and sandy loam.

Of minor extent are the moderately well drained Throckmorton soils on rises and gentle breaks along drainageways; the well drained Octagon, Lauramie, Longlois, and Mellott soils on knobs and breaks along drainageways; the very poorly drained Peotone soils in potholes; and the very poorly drained Sloan soils on flood plains.

A drainage system has been installed in most areas of this unit. Most areas are used for corn, soybeans, or small grain. Some areas are used for pasture or hay. A few areas are used for timber production. The soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Wetness and ponding are the main limitations.

The use of these soils for building site development is severely limited by ponding, wetness, restricted

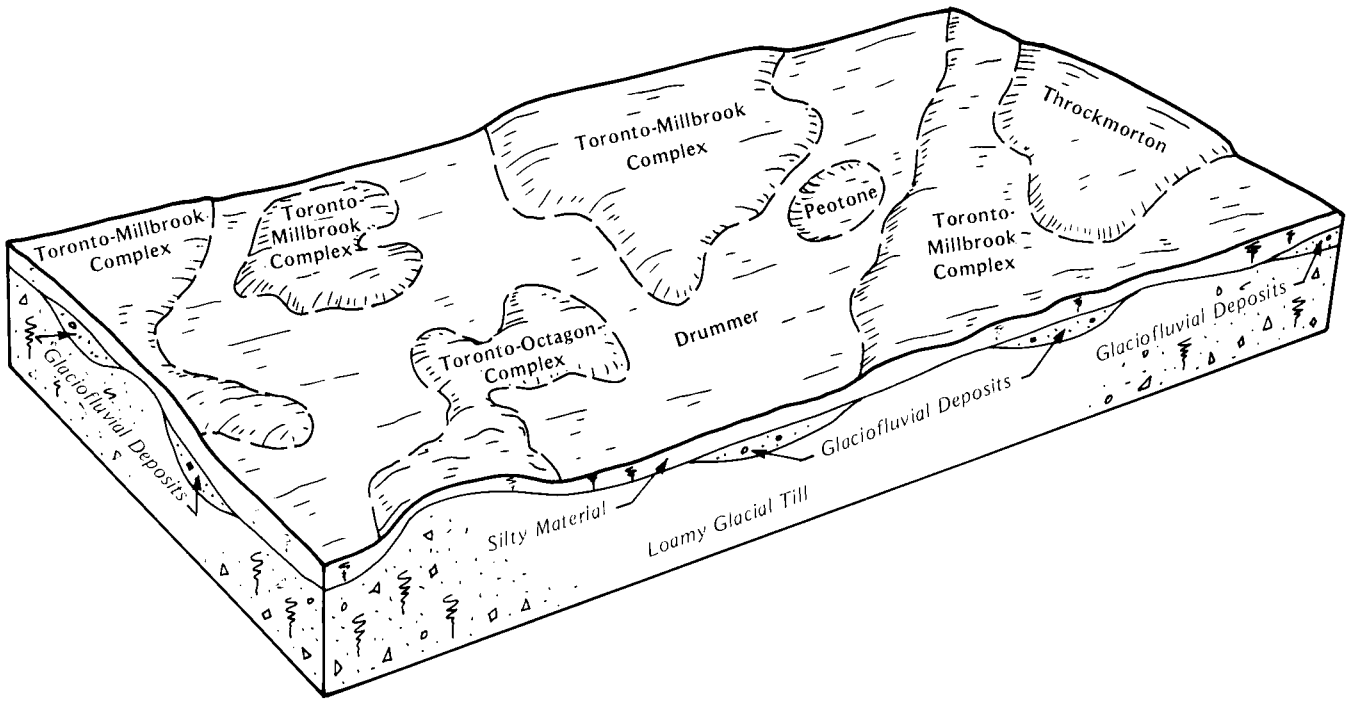


Figure 3.—Typical pattern of soils and parent material in the Drummer-Toronto-Millbrook general soil map unit.

permeability, low strength, and the potential for frost action.

2. Starks-Fincastle

Nearly level, somewhat poorly drained soils that formed in silty material and in the underlying glacial till or glaciofluvial deposits; on till plains

This map unit is on slight rises on glacial till plains characterized by many depressional areas and very little relief. Slopes range from 0 to 2 percent.

This map unit makes up about 21 percent of the county. It is about 27 percent Starks soils, 19 percent Fincastle soils, and 54 percent soils of minor extent.

Typically, the surface layer of the Starks soils is brown silt loam. The subsoil is brown and yellowish brown, mottled silty clay loam, silt loam, and loam.

Typically, the surface layer of the Fincastle soils is dark grayish brown silt loam. The subsoil is olive brown, dark yellowish brown, and yellowish brown, mottled silt loam, silty clay loam, clay loam, and loam.

Of minor extent are the well drained Miami and Richardville soils on knobs and breaks along drainageways; the moderately well drained Rockfield soils on rises and gentle breaks along drainageways; the somewhat poorly drained Crosby soils on rises and breaks along drainageways; and the very poorly drained Mahalasville, Treaty, Milford, and Pella soils in depressions and potholes.

A drainage system has been installed in most areas of this unit. Most areas are used for corn, soybeans, or small grain. Some areas are used for pasture, hay, or woodland. These soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. The major soils are well suited to trees. Wetness is the main limitation.

The use of these soils for building site development is severely limited by the wetness, low strength, and the potential for frost action.

3. Drummer-Raub-Brenton

Nearly level, poorly drained and somewhat poorly drained soils that formed in silty material and in the underlying glacial till or glaciofluvial deposits; on till plains

This map unit consists of soils in broad depressional areas and slight rises on glacial till plains. It is characterized by swale-and-swell topography and very little relief. Slopes range from 0 to 2 percent.

This map unit makes up about 6 percent of the county. It is about 45 percent Drummer soils, 15 percent Raub soils, 11 percent Brenton soils, and 29 percent soils of minor extent.

Drummer soils are poorly drained and are in

depressional areas. Some of the Drummer soils have a stratified sandy substratum. Typically, the surface layer of the Drummer soils that do not have a stratified sandy substratum is black silty clay loam. The subsoil is black, grayish brown, light brownish gray, and yellowish brown, mottled silty clay loam, silt loam, and clay loam. Typically, the surface layer of the Drummer soils that have a stratified sandy substratum is black silty clay loam. The subsoil is dark gray and olive gray, mottled silty clay loam and sandy loam.

Raub soils are somewhat poorly drained and are on slight rises. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of light olive brown and grayish brown, mottled silty clay loam, silt loam, clay loam, and loam.

Brenton soils are somewhat poorly drained and are on slight rises. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of olive brown and light olive brown, mottled silty clay loam, silt loam, sand, and sandy loam.

Of minor extent are the well drained Tecumseh soils on knobs and breaks along drainageways, the moderately well drained Throckmorton soils on rises and gentle breaks along drainageways, and the very poorly drained Milford and Pella soils in potholes.

A drainage system has been installed in most areas of this unit. Most areas are used for corn, soybeans, or small grain. Some areas are used for hay or pasture. A few areas are used for timber production. These soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Wetness and ponding are the main limitations.

The use of these soils for building site development is severely limited by the ponding, the wetness, low strength, and the potential for frost action.

4. Crosby-Mahalasville-Treaty

Nearly level, somewhat poorly drained and very poorly drained soils that formed in silty material and in the underlying glacial till or glaciofluvial deposits; on till plains

This map unit consists of soils on broad rises and in depressional areas on glacial till plains. It is characterized by swale-and-swell topography and very little relief. Slopes range from 0 to 2 percent.

This map unit makes up about 2 percent of the county. It is about 68 percent Crosby soils, 8 percent Mahalasville soils, 7 percent Treaty soils, and 17 percent soils of minor extent.

Crosby soils are somewhat poorly drained and are on slight rises. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown and yellowish brown, mottled clay loam and loam.

Mahalasville soils are very poorly drained and are in depressional areas. Typically, they have a surface layer of black silty clay loam and a subsoil of dark gray and grayish brown, mottled silty clay loam, loam, and silt loam.

Treaty soils are very poorly drained and are in depressional areas. Typically, they have a surface layer of very dark grayish brown silty clay loam and a subsoil of dark gray, dark grayish brown, and grayish brown, mottled silty clay loam, silt loam, and loam.

Of minor extent are the well drained Miami and Strawn soils adjacent to drainageways and on slope breaks between uplands and either terraces or areas of bottom land and the excessively drained Rodman soils adjacent to drainageways and on slope breaks between uplands and either terraces or flood plains.

A drainage system has been installed in most areas of this unit. Most areas are used for corn, soybeans, or small grain. Some areas are used for pasture, hay, or woodland. These soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. They are well suited to trees. Wetness and ponding are the main limitations.

The use of these soils for building site development is severely limited by the ponding, the wetness, low strength, and the potential for frost action.

5. Fincastle-Crosby-Miami

Nearly level and gently sloping, somewhat poorly drained and well drained soils that formed in silty material and in the underlying glacial till; on till plains

This map unit consists of soils on slight rises and along drainageways on glacial till plains. Slopes range from 1 to 6 percent.

This map unit makes up about 2 percent of the county. It is about 34 percent Fincastle soils, 34 percent Crosby soils, 11 percent Miami soils, and 21 percent soils of minor extent.

Fincastle soils are somewhat poorly drained and are on the broader flats and toe slopes. They are nearly level and gently sloping. Typically, they have a surface layer of dark brown silt loam and a subsoil of brown, grayish brown, and light brownish gray, mottled silty clay loam and loam.

Crosby soils are somewhat poorly drained and are on rises and breaks along drainageways. They are nearly level and gently sloping. Typically, they have a surface layer of dark brown silt loam and a subsoil of grayish brown, brown, light olive brown, and yellowish brown, mottled silty clay loam, clay loam, and loam.

Miami soils are well drained and are on knobs and breaks along drainageways. They are gently sloping.

Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown clay loam, loam, and sandy clay loam.

Of minor extent are the well drained Richardville soils on rises and slope breaks adjacent to drainageways and the very poorly drained Mahalasville and Treaty soils in depressional areas.

A drainage system has been installed in most areas of this unit. Most areas are used for corn, soybeans, or small grain. Some areas are used for pasture, hay, or woodland. These soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. They are well suited to trees. Wetness is the main limitation. Erosion is a concern in the sloping areas.

The use of these soils for building site development is moderately or severely limited by the wetness, the shrink-swell potential, low strength, and the potential for frost action.

Very Poorly Drained to Well Drained, Medium Textured and Moderately Fine Textured, Nearly Level to Strongly Sloping Soils; On Glacial Till Plains, Recessional Moraines, and Flood Plains

These map units are made up of soils that have a seasonal high water table or are subject to erosion. These soils make up about 16 percent of the county. Most areas are drained and are used for corn, soybeans, or small grain. Many of the steeper areas are used for hay, pasture, or woodland. The more level areas are well suited to row crops. The limitations affecting building site development range from moderate to severe.

6. Marker-Drummer-Beecher

Nearly level and gently sloping, moderately well drained, poorly drained, and somewhat poorly drained soils that formed in glacial till or silty material and in the underlying glacial till or glaciofluvial deposits; on recessional moraines

This map unit is made up of soils on broad rises and in depressional areas on glacial moraines. It is characterized by ridges that are dissected by many drainageways. Slopes range from 0 to 6 percent.

This map unit makes up about 1 percent of the county. It is about 47 percent Marker soils, 31 percent Drummer soils, 13 percent Beecher soils, and 9 percent soils of minor extent.

Marker soils are moderately well drained and are on knobs and breaks along drainageways. They are gently sloping. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of olive brown and light olive brown, mottled clay loam and silt loam.

Drummer soils are poorly drained and are in drainageways and depressional areas. They are nearly level. Some of the Drummer soils have a stratified sandy substratum. Typically, the surface layer of the Drummer soils that do not have a stratified sandy substratum is black silty clay loam. The subsoil is black, grayish brown, light brownish gray, and yellowish brown, mottled silty clay loam, silt loam, and clay loam. Typically, the surface layer of the Drummer soils that have a stratified sandy substratum is black silty clay loam. The subsoil is dark gray and olive gray, mottled silty clay loam and sandy loam.

Beecher soils are somewhat poorly drained and are on broad flat ridgetops and toe slopes. They are nearly level. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of olive brown and light olive brown, mottled silty clay loam.

Of minor extent are the well drained Miami and Octagon soils on knobs and breaks along drainageways and the somewhat poorly drained Toronto and Millbrook soils on toe slopes and at the lower elevations.

A drainage system has been installed in most areas of this unit. Most areas are used for corn, soybeans, or small grain. Some areas are used for pasture or hay. A few areas are used for timber production. These soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Wetness is the main limitation. Erosion is a hazard in areas of the Marker soils.

The use of the soils in this unit for building site development is moderately or severely limited by ponding, the wetness, low strength, and the potential for frost action.

7. Miami-Crosby-Richardville

Gently sloping to strongly sloping, well drained and somewhat poorly drained soils that formed in silty material and in the underlying glacial till or glaciofluvial deposits; on till plains and recessional moraines

This map unit consists of soils in rolling areas on till plains and moraines that are dissected by many drainageways and small streams. Some areas along the larger streams are characterized by steep, short breaks. Slopes range from 2 to 18 percent.

This map unit makes up about 11 percent of the county. It is about 24 percent Miami soils, 21 percent Crosby soils, 14 percent Richardville soils, and 41 percent soils of minor extent.

Miami soils are well drained and are on knobs and breaks along drainageways. They are gently sloping to

strongly sloping. Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown clay loam, loam, and sandy loam.

Crosby soils are somewhat poorly drained and are on toe slopes and in drainageways. They are gently sloping. Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown and yellowish brown, mottled silty clay loam, clay loam, and loam.

Richardville soils are well drained and are on knobs and breaks along drainageways. They are gently sloping and moderately sloping. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark brown and dark yellowish brown silty clay loam and clay loam.

Of minor extent are the excessively drained Rodman and well drained Strawn soils on steep breaks along streams, the well drained Ockley soils on terraces, and the very poorly drained Sloan and Cohoctah soils on flood plains.

Most areas have been cleared and are used for corn, soybeans, or small grain. The more sloping areas are used for hay, pasture, or woodland. The gently sloping areas are well suited to corn, soybeans, and small grain. The gently sloping and moderately sloping areas are well suited to grasses and legumes for hay or pasture, and the strongly sloping soils are fairly well suited. The soils in this unit are well suited to trees. A drainage system is needed for optimum production in areas of the Crosby soils. Erosion is a concern throughout this unit.

The use of these soils for building site development is moderately or severely limited by the shrink-swell potential, the wetness, low strength, the slope, and the potential for frost action.

8. Octagon-Drummer-Lauramie-Throckmorton

Nearly level to moderately sloping, well drained, poorly drained, and moderately well drained soils that formed in silty material and in the underlying glacial till or glaciofluvial deposits; on till plains and recessional moraines

This map unit is made up of soils in rolling areas on till plains and moraines that are dissected by many drainageways and small streams. Steeper slopes are along many of the drainageways. Slopes range from 0 to 12 percent.

This map unit makes up about 1 percent of the county. It is about 37 percent Octagon soils, 28 percent Drummer soils, 13 percent Lauramie soils, 11 percent Throckmorton soils, and 11 percent soils of minor extent.

Octagon soils are well drained and are on knobs and breaks along drainageways. They are gently sloping and moderately sloping. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of dark yellowish brown and yellowish brown clay loam and sandy clay loam.

Drummer soils are poorly drained and are in depressional areas. They are nearly level. Some of the Drummer soils have a stratified sandy substratum. Typically, the surface layer of the Drummer soils that do not have a stratified sandy substratum is black silty clay loam. The subsoil is black, grayish brown, light brownish gray, and yellowish brown, mottled silty clay loam, silt loam, and clay loam. Typically, the surface layer of the Drummer soils that have a stratified sandy substratum is black silty clay loam. The subsoil is dark gray and olive gray, mottled silty clay loam and sandy loam.

Lauramie soils are well drained and are on knobs and breaks along drainageways and small streams. They are gently sloping. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark brown and dark yellowish brown silty clay loam, clay loam, and sandy loam.

Throckmorton soils are moderately well drained and are on broad ridgetops and rises. They are nearly level and gently sloping. Typically, they have a surface layer of very dark gray silt loam and a subsoil of dark brown, dark yellowish brown, and yellowish brown, mottled silt loam, silty clay loam, clay loam, sandy loam, and loam.

Of minor extent are the well drained Mellott and Tecumseh soils on broad ridgetops, the somewhat poorly drained Toronto and Millbrook soils in drainageways and on toe slopes, and the very poorly drained Sloan soils on flood plains.

Most areas are used for corn, soybeans, or small grain. The more sloping areas are used for hay or pasture. A few areas are used for timber production. The gently sloping and nearly level areas are well suited to corn, soybeans, and small grain, and the moderately sloping areas are fairly well suited. The soils in this unit are well suited to grasses and legumes for hay or pasture. Erosion is a concern in the sloping areas. Ponding and wetness are concerns in areas of the Drummer soils.

The use of these soils for building site development is moderately or severely limited by the shrink-swell potential, low strength, the ponding, the slope, and the potential for frost action.

9. Camden-Richardville-Starks-Fincastle

Nearly level to moderately sloping, well drained and somewhat poorly drained soils that formed in silty

material and in the underlying glacial till or glaciofluvial deposits; on till plains

This map unit consists of soils in rolling areas bordering stream valleys and outwash plains. Some areas along the larger streams are characterized by steep, short breaks. Slopes range from 0 to 12 percent.

This map unit makes up about 1 percent of the county. It is about 24 percent Camden soils, 15 percent Richardville soils, 12 percent Starks soils, 9 percent Fincastle soils, and 40 percent soils of minor extent.

Camden soils are well drained and are either on flat ridgetops between drainageways or adjacent to streams. They are nearly level. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown and dark brown silt loam, silty clay loam, loam, and sandy loam.

Richardville soils are well drained and are on knobs and breaks along drainageways and small streams. They are nearly level to moderately sloping. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark brown and dark yellowish brown silty clay loam and clay loam.

Starks soils are somewhat poorly drained and are in drainageways and on toe slopes. They are nearly level. Typically, they have a surface layer of brown silt loam and a subsoil of brown and yellowish brown, mottled silty clay loam, silt loam, and loam.

Fincastle soils are somewhat poorly drained and are in drainageways and on toe slopes. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of olive brown, dark yellowish brown, and yellowish brown, mottled silt loam, silty clay loam, clay loam, and loam.

Of minor extent are the very poorly drained Mahalasville, Treaty, and Milford soils in depressional areas and potholes; the well drained Miami and Strawn soils on the steeper breaks along drainageways and streams; and the excessively drained Rodman soils on steep breaks along streams.

Most areas have been cleared and are used for corn, soybeans, or small grain. Some areas are used for pasture, hay, or woodland. The nearly level and gently sloping areas are well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. This unit is well suited to trees. A drainage system is needed in areas of the Starks and Fincastle soils for optimum production. Erosion is a concern in the more sloping areas.

The use of these soils for building site development is moderately or severely limited by the wetness, the slope, low strength, and the potential for frost action.

10. Lauramie-Tecumseh-Linkville, Loamy Substratum

Nearly level and gently sloping, well drained soils that formed in silty material or glaciofluvial deposits and in the underlying glacial till; on till plains and recessional moraines

This map unit consists of soils in rolling areas on glacial till plains and moraines bordering outwash plains. Some areas along the larger streams are characterized by short, steep breaks. Slopes range from 0 to 6 percent.

This map unit makes up about 1 percent of the county. It is about 23 percent Lauramie soils, 18 percent Tecumseh soils, 15 percent Linkville soils, and 44 percent soils of minor extent.

Lauramie soils are on knobs and breaks along drainageways and streams. They are nearly level and gently sloping. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark brown and dark yellowish brown silty clay loam, clay loam, and sandy loam.

Tecumseh soils are on broad flats. They are nearly level. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of dark brown, dark yellowish brown, and yellowish brown silt loam, silty clay loam, clay loam, sandy loam, and loam.

Linkville soils have a loamy substratum. They are on toe slopes, ridgetops, and side slopes. They are nearly level and gently sloping. Typically, they have a surface layer of very dark gray loam and a subsoil of dark brown, brown, and dark yellowish brown loam and clay loam.

Of minor extent are the poorly drained Drummer soils in depressional areas and drainageways; the somewhat poorly drained La Hogue, Toronto, and Millbrook soils at the lower elevations and on toe slopes; the moderately well drained Throckmorton soils on toe slopes and in drainageways; the well drained Octagon and Strawn soils and the excessively drained Rodman soils on the steeper breaks along drainageways and streams; and the excessively drained Sparta soils on the ridges of sand dunes.

Most areas are used for corn, soybeans, or small grain. Some areas are used for pasture or hay. A few areas are used for timber production. These soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Erosion is a concern in the sloping areas.

The use of these soils for building site development is moderately or severely limited by the shrink-swell potential, low strength, and the potential for frost action.

11. Rainsville-Sloan-Miami-Rockfield

Nearly level to strongly sloping, moderately well drained, very poorly drained, and well drained soils that formed in silty material and in the underlying glaciofluvial deposits and glacial till or alluvium; on till plains, recessional moraines, and flood plains

This map unit consists of soils in rolling areas on till plains, moraines, and flood plains. It is dissected by many drainageways and has many depressional areas. Slopes range from 0 to 18 percent.

This map unit makes up about 1 percent of the county. It is about 22 percent Rainsville soils, 18 percent Sloan soils, 16 percent Miami soils, 12 percent Rockfield soils, and 32 percent soils of minor extent.

Rainsville soils are moderately well drained and are on knobs and breaks along drainageways. They are gently sloping. Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown, yellowish brown, and light olive brown, mottled silty clay loam, clay loam, sandy loam, and loam.

Sloan soils are very poorly drained and are on flood plains. They are nearly level. Typically, they have a surface layer of black clay loam and a subsoil of grayish brown, mottled loam that has strata of sandy loam.

Miami soils are well drained and are on knobs and breaks along drainageways and small streams. They are gently sloping to strongly sloping. Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown and yellowish brown silty clay loam, clay loam, and loam.

Rockfield soils are moderately well drained and are on ridgetops and gentle breaks along drainageways. They are nearly level and gently sloping. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown and light olive brown, mottled silty clay loam, clay loam, and loam.

Of minor extent are the well drained Richardville soils on knobs and breaks along drainageways, the well drained Strawn and excessively drained Rodman soils on steep breaks adjacent to flood plains, the somewhat poorly drained Starks and Fincastle soils on flat ridgetops and in low areas, and the very poorly drained Mahalasville and Treaty soils in depressional areas.

Most areas have been cleared and are used for corn, soybeans, or small grain. Generally, the more sloping areas are used for hay, pasture, or woodland. The nearly level and gently sloping areas are well suited to corn, soybeans, and small grain. The nearly level to moderately sloping areas are well suited to grasses and legumes for hay and pasture, and the strongly sloping soils are fairly well suited. This unit is well suited to trees. A drainage system is needed in areas of the Sloan soils for optimum yields. Erosion is a hazard in the more sloping areas. Flooding is a hazard in areas of the Sloan soils.

The use of the soils in this unit for building site development is moderately or severely limited by the shrink-swell potential, the slope, the wetness, low strength, and the potential for frost action. The ponding and the flooding are severe limitations in areas of the Sloan soils.

Well Drained, Somewhat Poorly Drained, and Very Poorly Drained, Moderately Fine Textured to Moderately Coarse Textured, Nearly Level to Strongly Sloping Soils; On Terraces, Outwash Plains, and Kames

These map units are made up of soils underlain by sand and gravel. These soils make up about 16 percent of the county. Most areas are used for corn, soybeans, or small grain. Many of the steeper areas are used for hay, pasture, or woodland. The more level areas are well suited to row crops. The limitations affecting building site development range from slight to severe.

12. Elston, Gravelly Substratum-Carmi

Nearly level and gently sloping, well drained soils that formed in loamy outwash and in the underlying gravelly outwash deposits; on terraces and outwash plains

This map unit consists of soils on flats and along elevation breaks on terraces and broad outwash plains adjacent to the Wabash River. Slopes range from 0 to 6 percent.

This map unit makes up about 7 percent of the county. It is about 44 percent Elston soils, 16 percent Carmi soils, and 40 percent soils of minor extent (fig. 4).

The Elston soils in this map unit have a gravelly substratum. They are on terraces and broad flats on outwash plains. They are nearly level. Typically, they have a surface layer of very dark brown loam and a subsoil of dark yellowish brown and dark brown loam, sandy loam, and loamy sand.

Carmi soils are on terraces and outwash plains. They are nearly level and gently sloping. Typically, they have a surface layer of very dark gray loam and a subsoil of dark brown loam, gravelly loam, gravelly sandy loam, and gravelly loamy sand.

Of minor extent are the well drained Troxel soils in depressional areas, the well drained Desker soils on the steeper terrace breaks, the excessively drained Rodman soils on steep terrace breaks, the excessively drained Sparta soils on gently sloping and moderately sloping sand dunes, and the well drained Battleground and Allison soils on flood plains.

Most areas are used for corn, soybeans, or small

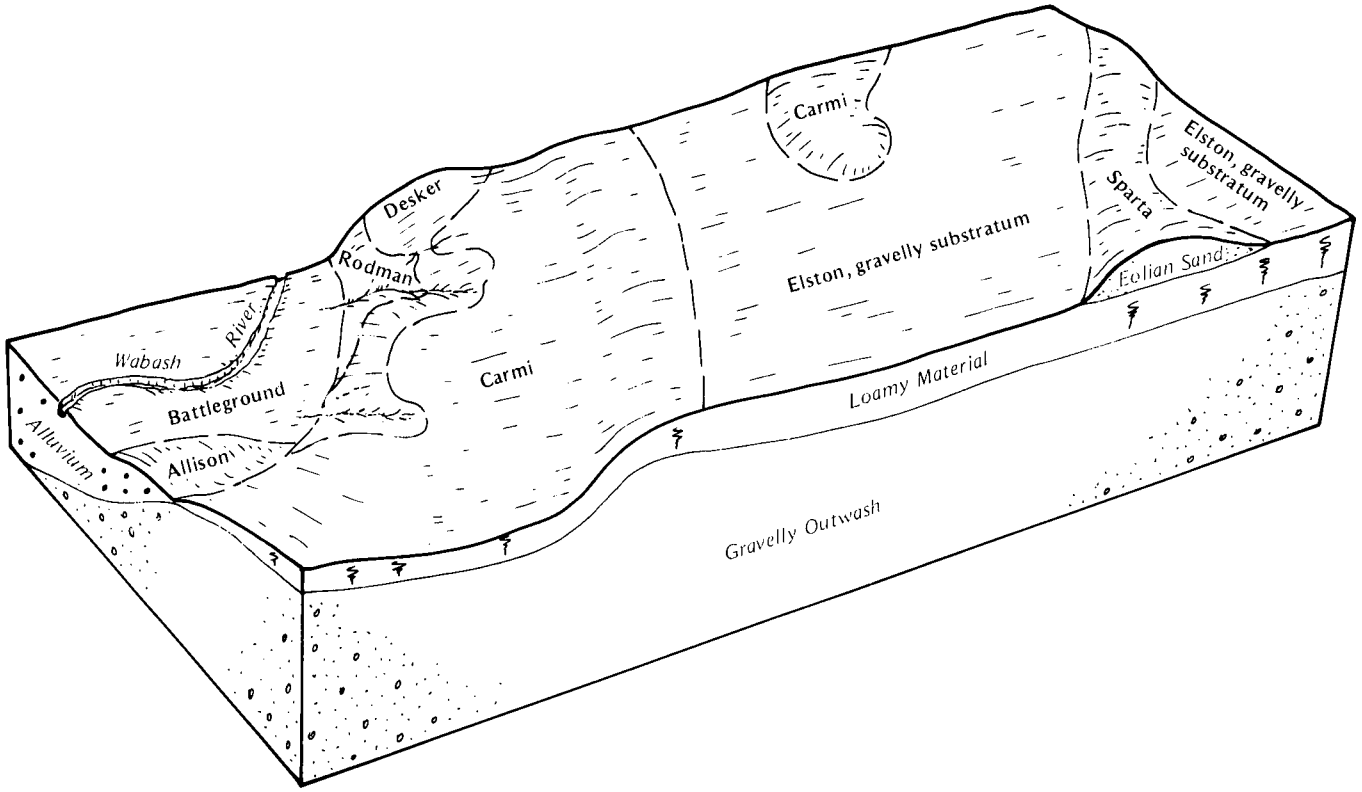


Figure 4.—Typical pattern of soils and parent material in the Elston, gravelly substratum-Carmi general soil map unit.

grain. Some areas are used for pasture or hay. A few areas are used for timber production. The Elston soils are fairly well suited to corn, soybeans, and small grain, and the Carmi soils are well suited. The soils in this unit are well suited to grasses and legumes for hay or pasture. Droughtiness is a limitation, and soil blowing is a hazard. Erosion is a concern in the gently sloping areas of the Carmi soils.

The potential for frost action is a moderate limitation if these soils are used for building site development.

13. Mahalasville, Gravelly Substratum-Waupecan-Lafayette

Nearly level, very poorly drained, well drained, and somewhat poorly drained soils that formed in silty material and in the underlying loamy and gravelly outwash deposits; on outwash plains

This map unit consists of soils in broad depressional areas and on rises on outwash plains. It is characterized by swale-and-swell topography. A drainage system has been installed in most areas. Slopes range from 0 to 2 percent.

This map unit makes up about 5 percent of the county. It is about 38 percent Mahalasville soils, 24 percent Waupecan soils, 10 percent Lafayette soils, and 28 percent soils of minor extent.

The Mahalasville soils in this map unit have a gravelly substratum. They are very poorly drained and are in depressional areas. Typically, they have a surface layer of black silty clay loam and a subsoil of very dark gray, dark gray, grayish brown, and dark olive gray, mottled silty clay loam, clay loam, and sandy clay loam.

Waupecan soils are well drained and are in broad flat areas on low rises. Typically, they have a surface layer of very dark gray silt loam and a subsoil of dark brown and dark yellowish brown silt loam, silty clay loam, sandy loam, and loamy sand.

Lafayette soils are somewhat poorly drained and are on low rises and in broad, low areas. Typically, they have a surface layer of very dark gray silt loam and a subsoil of brown, dark yellowish brown, yellowish brown, grayish brown, and dark grayish brown, mottled silt loam, silty clay loam, sandy loam, loamy coarse sand, and gravelly sandy loam.

Of minor extent are the well drained Bowes soils, the

moderately well drained Bowes Variant soils, and the somewhat poorly drained Mulvey and Waynetown soils on low rises.

Most areas are used for corn, soybeans, or small grain. Some areas are used for pasture or hay. A few areas are used for timber production. These soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. A drainage system is needed in areas of the Mahalasville and Lafayette soils for optimum production.

The use of these soils for building site development is moderately or severely limited by the ponding, the wetness, the shrink-swell potential, low strength, and the potential for frost action.

14. Longlois, Kame-Desker, Kame

Gently sloping to strongly sloping, well drained soils that formed either in silty material and the underlying loamy and gravelly outwash or in gravelly outwash; on kames

This map unit consists of soils on kames. It is characterized by a series of elongated ridges that are typically higher than the surrounding landscape. Slopes range from 2 to 18 percent.

This map unit makes up about 1 percent of the county. It is about 34 percent Longlois soils, 25 percent Desker soils, and 41 percent soils of minor extent.

Longlois soils are in gently sloping areas on kames. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown and dark brown silty clay loam, clay loam, sandy clay loam, and sandy loam.

Desker soils are in moderately sloping to strongly sloping areas on kames. Typically, they have a surface layer of very dark grayish brown sandy loam and a subsoil of dark brown and dark yellowish brown sandy loam, coarse sandy loam, and gravelly loamy sand.

Of minor extent are the excessively drained Rodman soils on knobs and steep side slopes; the well drained Camden, Mellott, Bowes, and Waupecan soils on toe slopes and flat ridgetops; the well drained Troxel soils in depressions; and the somewhat poorly drained Toronto and Millbrook soils on toe slopes and in low areas.

Most areas are used for corn, soybeans, or small grain. Some areas are used for hay, pasture, or woodland. The less sloping areas are well suited to corn, soybeans, and small grain. The soils in this unit are well suited to grasses and legumes for hay and pasture. Droughtiness and the hazard of erosion are the main management concerns.

The use of these soils for building site development is moderately or severely limited by the shrink-swell potential, the potential for frost action, low strength, and the slope.

15. Billett, Gravelly Substratum-Kalamazoo

Nearly level and gently sloping, well drained soils that formed in loamy outwash and in the underlying gravelly outwash deposits; on terraces and outwash plains

This map unit consists of soils on flats and along elevation breaks on terraces and broad outwash plains adjacent to the Wabash River. Slopes range from 0 to 6 percent.

This map unit makes up about 3 percent of the county. It is about 54 percent Billett soils, 40 percent Kalamazoo soils, and 6 percent soils of minor extent.

The Billett soils in this map unit have a gravelly substratum. They are on broad flats, terrace breaks, and breaks along drainageways. Typically, they have a surface layer of brown loam and a subsoil of brown and dark brown loam, sandy clay loam, and loamy coarse sand.

Kalamazoo soils are on broad flats, terrace breaks, and breaks along drainageways. Typically, they have a surface layer of brown loam and a subsoil of brown and dark brown loam, sandy clay loam, and loamy coarse sand.

Of minor extent are the excessively drained Rodman and well drained Strawn soils on steep breaks and the well drained Kosciusko soils on the more sloping terraces and breaks along outwash plains.

Most areas are used for corn, soybeans, or small grain. Some areas are used for hay, pasture, or woodland. These soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. They are well suited to trees. Erosion is the main hazard in the sloping areas. Soil blowing is a concern in areas of the Billett soils.

The potential for frost action is a moderate limitation if these soils are used for building site development.

Well Drained and Excessively Drained, Medium Textured and Moderately Coarse Textured, Moderately Steep to Very Steep Soils; On Till Plains, Terraces, and Outwash Plains

These map units are made up mostly of shallow soils that have slopes of more than 18 percent. These soils make up about 2 percent of the county. Most areas are used as woodland. Some areas are used for hay or pasture. The soils are generally unsuited to row crops. The limitations affecting building site development are severe.

16. Strawn-Rodman

Moderately steep to very steep, well drained and excessively drained soils that formed in glacial till or gravelly outwash; on till plains, outwash plains, and terraces

This map unit consists of soils on steep breaks between flood plains and uplands or terraces and on steep-sided drainageways along streams. It is generally characterized by steep valleys and narrow flood plains, mostly less than ⅛ mile wide. Slopes range from 18 to 60 percent.

This map unit makes up about 2 percent of the county. It is about 31 percent Strawn soils, 23 percent Rodman soils, and 46 percent soils of minor extent (fig. 5).

Strawn soils are well drained and are on the upper part of steep glacial till plain breaks and drainageways. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of dark yellowish brown loam.

Rodman soils are excessively drained and are on the lower part of steep glacial till plain breaks and drainageways. Typically, they have a surface layer of very dark gravelly sandy loam and a subsoil of dark brown gravelly loamy coarse sand.

Of minor extent are the well drained Miami and Richardville soils on the less sloping upper part of side slopes and ridgetops; the well drained Ockley and Kalamazoo soils on the less sloping terrace ridgetops and side slopes; and the somewhat excessively drained Ouiatenon soils on narrow flood plains.

Most areas are used as woodland. Some of the less sloping areas and areas on flood plains are used for corn, soybeans, or small grain or for hay and pasture. These soils are generally unsuited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. They are poorly suited to trees. The slope and the hazard of erosion are the main management concerns.

The slope is a severe limitation if these soils are used for building site development.

Excessively Drained, Somewhat Excessively Drained, Well Drained, Somewhat Poorly Drained, and Very Poorly Drained, Medium Textured to Coarse Textured, Nearly Level Soils; On Flood Plains and Low Terraces

These map units consist of soils that border streams and rivers. Most areas are subject to flooding. These soils make up about 8 percent of the county. Most areas are used for corn or soybeans. Some areas are used for hay, pasture, or woodland. The soils generally are well suited to cultivated crops. The limitations affecting building site development are severe.

17. Battleground-Allison-Lash

Nearly level, well drained soils that formed in alluvial deposits; on flood plains

This map unit consists of soils on broad flood plains along the Wabash River. Slopes range from 0 to 2 percent.

This map unit makes up about 4 percent of the county. It is about 37 percent Battleground soils, 10 percent Allison soils, 9 percent Lash soils, and 44 percent soils of minor extent.

Battleground soils are generally in large areas adjacent to the river channel. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of dark brown silty clay loam.

Allison soils are generally in the slightly higher areas adjacent to terraces and uplands. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of dark brown silty clay loam.

Lash soils are generally in the slightly higher areas on flood plains. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of dark brown silt loam and loam.

Of minor extent are the very poorly drained Sawabash and somewhat poorly drained Tice soils in depressional areas; the well drained Du Page, Wea, Ross, and Pinevillage soils in the higher areas on flood plains; the somewhat excessively drained Ouiatenon soils that have a sandy substratum on rises and in areas adjacent to the river channel; and the well drained Strawn and excessively drained Rodman soils on steep breaks between flood plains and the uplands or terraces.

Most areas are used for corn or soybeans. A few areas are used for pasture, hay, or woodland. These soils are well suited to corn and soybeans and to grasses and legumes for hay or pasture. They are poorly suited to small grain because of the flooding. They are well suited to trees. The flooding is the major management concern.

These soils are generally unsuited to building site development because of the flooding, low strength, and the potential for frost action.

18. Ouiatenon-Ceresco, Gravelly Substratum-Cohoctah, Gravelly Substratum-Hononegah

Nearly level, somewhat excessively drained, somewhat poorly drained, very poorly drained, and excessively drained soils that formed in alluvial deposits or outwash deposits; on flood plains and stream terraces

This map unit consists of soils on flood plains and low terraces along the smaller streams and rivers that

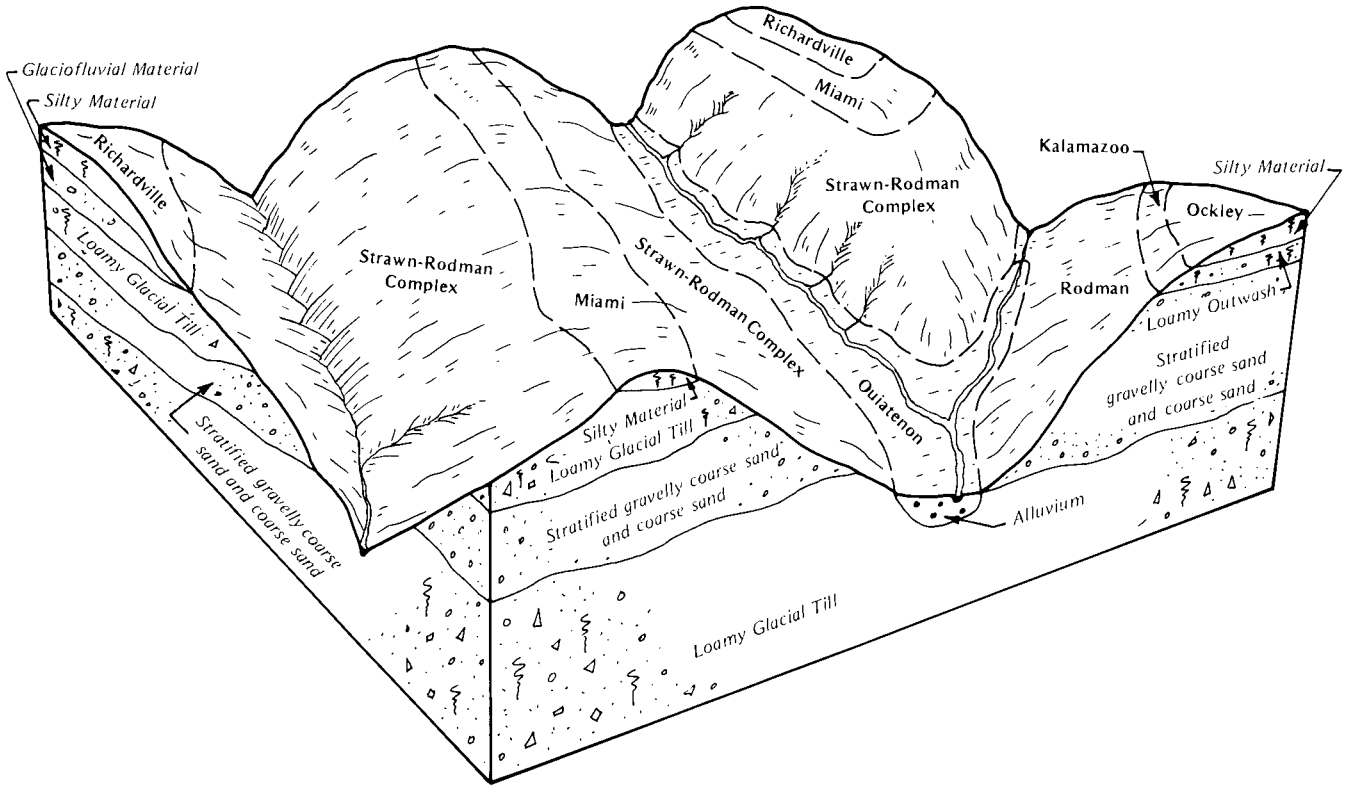


Figure 5.—Typical pattern of soils and parent material in the Strawn-Rodman general soil map unit.

flow into the Wabash River. Slopes range from 0 to 2 percent.

This map unit makes up about 4 percent of the county. It is about 40 percent Ouiatenon soils, 20 percent Ceresco soils, 18 percent Cohoctah soils, 15 percent Hononegah soils, and 7 percent soils of minor extent (fig. 6).

Ouiatenon soils are somewhat excessively drained and are generally in areas adjacent to stream channels. Typically, they have a surface layer of very dark gray loamy sand and dark brown coarse sand and are very gravelly coarse sand in the underlying material.

The Ceresco soils in this unit have a gravelly substratum. They are somewhat poorly drained and are generally in low areas adjacent to uplands and terraces on flood plains. Typically, they have a surface layer of very dark gray loam and a subsoil of dark yellowish brown and dark grayish brown, mottled fine sandy loam.

The Cohoctah soils in this unit have a gravelly substratum. They are very poorly drained and are generally in depressional areas adjacent to uplands and terraces on flood plains. Typically, they have a surface layer of very dark gray fine sandy loam and a subsoil of dark grayish brown and grayish brown, mottled fine sandy loam and loamy fine sand.

Hononegah soils are excessively drained and are on low terraces adjacent to narrow flood plains. Typically, they have a surface layer of very dark grayish brown fine sandy loam and a subsoil of dark yellowish brown and dark brown fine sandy loam, loamy sand, gravelly loamy sand, and gravelly sand.

Of minor extent are the well drained Strawn and excessively drained Rodman soils on steep breaks between flood plains or low terraces and uplands or high terraces; the well drained Pinevillage soils on toe slopes of the steep breaks between flood plains and either terraces or uplands; the very poorly drained Mahalasville soils that have a gravelly substratum in depressional areas on low terraces; and the very poorly drained Saranac soils that have a gravelly substratum in depressional areas on flood plains.

Most areas have been cleared and are used for corn, soybeans, or small grain. A drainage system has been installed in most of these areas. Many areas are used as woodland, and a few areas are used for hay or pasture. The Ouiatenon and Hononegah soils are fairly well suited to cultivated crops. The Ceresco and Cohoctah soils are well suited to cultivated crops.

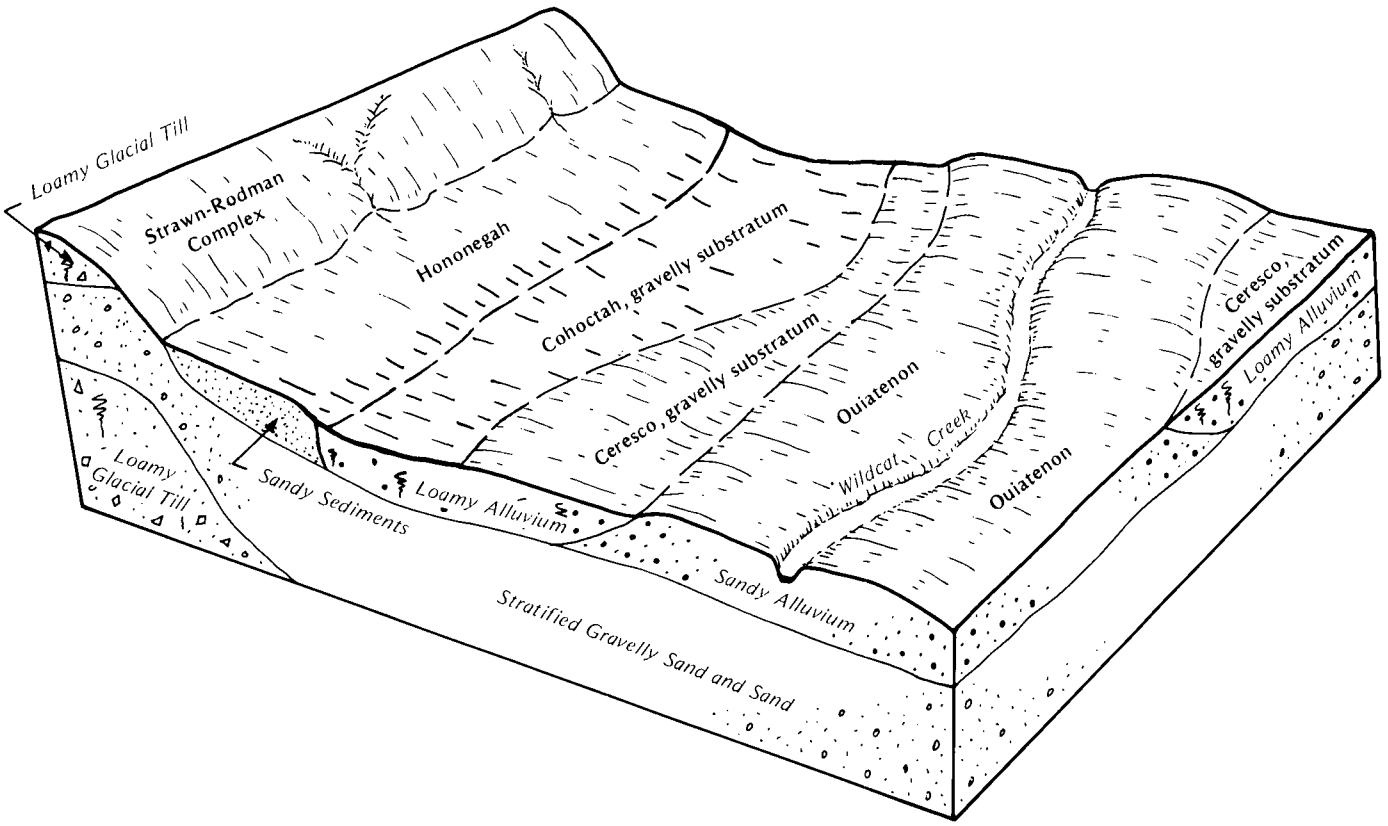


Figure 6.—Typical pattern of soils and parent material in the Ouiatenon-Ceresco, gravelly substratum-Cohoctah, gravelly substratum-Hononegah general soil map unit.

Hononegah soils are poorly suited to cultivated crops. The soils in this unit are well suited to grasses and legumes for hay or pasture, but flooding may destroy stands of small grain. The soils are well suited to trees. Droughtiness is a limitation in areas of the Ouiatenon and Hononegah soils. The flooding, the hazard of soil blowing, and ponding also are management concerns in areas of this unit. The wetness is a concern in areas of the Ceresco and Cohoctah soils.

Generally, the use of these soils for building site development is severely limited by the flooding, the ponding, the wetness, and the potential for frost action. The Hononegah soils are suitable for building site development.

Moderately Well Drained, Somewhat Poorly Drained, and Very Poorly Drained, Moderately Fine Textured and Medium Textured, Nearly Level to Moderately Sloping Soils; On Uplands and Flood Plains

These map units consist of soils underlain by interbedded siltstone and shale bedrock. These soils make up about 1 percent of the county. Most areas are used for corn, soybeans, or small grain. Some areas are used for hay, pasture, or woodland. The less sloping soils are well suited to row crops. The limitations affecting building site development are moderate or severe.

19. High Gap Variant-Sloan Variant-Shadeland

Nearly level to moderately sloping, moderately well drained, very poorly drained, and somewhat poorly drained soils that formed in silty material or glacial drift and in the underlying residuum derived from siltstone and shale bedrock; on uplands and flood plains

This map unit consists of soils on breaks either between flood plains and uplands or between outwash plains and uplands and on flood plains. Some areas adjacent to the flood plains have steep, short breaks that are outcrops of bedrock. Slopes range from 0 to 12 percent.

This map unit makes up less than 1 percent of the county. It is about 34 percent High Gap Variant soils, 27 percent Sloan Variant soils, 22 percent Shadeland soils,

and 17 percent soils of minor extent.

High Gap Variant soils are moderately well drained and are on knobs and breaks along drainageways adjacent to flood plains. They are nearly level to moderately sloping. Typically, they have a surface layer of dark brown silt loam and a subsoil of dark yellowish brown and dark brown, mottled silt loam, clay loam, and channery clay loam.

Sloan Variant soils are very poorly drained and are on broad flood plains underlain by bedrock. They are nearly level. Typically, they have a surface layer of black silty clay loam and a subsoil of very dark gray and dark grayish brown, mottled silty clay loam, very channery sandy clay loam, and extremely channery sandy clay loam.

Shadeland soils are somewhat poorly drained and are on flats and toe slopes and in drainageways. They are nearly level and gently sloping. Typically, they have a surface layer of dark brown silt loam and a subsoil of brown, dark brown, and strong brown, mottled silt loam, silty clay loam, clay loam, and channery clay loam.

Of minor extent are the somewhat excessively drained Ouiatenon and very poorly drained Sawabash soils on the lower flood plains, the well drained Pinevillage soils on the higher flood plains, the well drained Berks soils on steep hillslopes, and the very poorly drained Mahalasville soils that have a shale substratum in depressions and drainageways.

Most areas have been cleared and are used for corn, soybeans, or small grain. A drainage system has been installed in these areas. Some areas are used for hay, pasture, or woodland. The nearly level and gently sloping areas of the High Gap Variant and Shadeland soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The Sloan Variant soils are fairly well suited to corn and soybeans. The High Gap Variant soils are fairly well suited to trees, the Sloan Variant soils are poorly suited, and the Shadeland soils are well suited. A drainage system is needed for optimum production in areas of the Sloan Variant and Shadeland soils. Flooding is a management concern in areas of the Sloan Variant soils, and erosion is a concern in the more sloping areas.

The use of the soils in this unit for building site development is moderately or severely limited by the wetness, low strength, and the potential for frost action. Flooding and ponding are additional limitations in areas of the Sloan Variant soils.

Broad Land Use Considerations

The potential of the soils in Tippecanoe County for major land uses is variable. Decisions regarding which land should be used for urban development or for agriculture are important issues in the county now and will probably become even more important in the future. The general soil map is helpful in planning the general outline for specific uses, such as urban development, but it cannot be used to select specific sites for buildings. Data on specific soils can be helpful in planning future land use patterns in the county.

An estimated 71 percent of the county, or about 229,000 acres, is used for cultivated crops, mainly corn, soybeans, and small grain. This acreage is throughout the county. Wetness is the major limitation in areas of general soil map units 1, 2, 3, 4, 5, 6, 7, 13, 18, and 19, but most areas of these units have been artificially drained. Erosion is a hazard in areas of the sloping soils in map units 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, and 19. Flooding is a concern if cultivated crops are grown in areas of map units 11, 17, 18, and 19.

About 3 percent of the county, or about 9,700 acres, is used for hay or pasture. This acreage is scattered throughout the county but is concentrated in the more sloping areas, such as those in map units 7, 8, and 9. All of the map units, except for map unit 16, are well suited to grasses and legumes for hay or pasture. Flooding is a hazard if grasses and legumes are grown in areas of map units 11, 17, 18, and 19.

An estimated 5 percent of the county, or about 16,500 acres, is woodland. Small woodlots are scattered throughout the county, but they are not extensive because most of the land has been cleared and is used for cultivated crops. Most of the woodland is concentrated in map units 7, 9, 11, 16, and 18. The soils in map units 2, 4, 5, 7, 9, 11, 15, 17, 18, and 19 are mostly well suited to trees.

Each year a considerable amount of land is developed for urban uses around the cities of Lafayette and West Lafayette and in scattered small areas throughout the county. It is estimated that about 7 percent of the county, or about 24,000 acres, is urban or built-up land. Areas where the soils are so unfavorable that the cost of urban development is nearly prohibitive are extensive in the county. Flooding is a hazard, for example, in areas of map units 17 and 18, in areas of the Sloan soils in map unit 11, and in areas of the Sloan Variant soils in map unit 19. These soils are on flood plains. The slope is a severe limitation in areas of map unit 16 that are used for urban development. Most of the soils in map units 1, 2, 3, 4, 5, 6, and 13 have severe limitations affecting urban development. These limitations are the result of ponding, wetness, restricted permeability, low strength, and the potential for frost action. Most of these soils have a seasonal high water table, and extensive surface and subsurface drainage is necessary if they

are to be developed for urban uses. In general, the soils in map units 7, 8, 9, 10, 11, 12, 14, and 15 and the Waupecan soils in map unit 13 have moderate or severe limitations affecting urban development. The shrink-swell potential, low strength, and the potential for frost action are concerns in areas of these soils. The Hononegah soils in map unit 18 are suitable for building site development.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Miami silt loam, 6 to 12 percent slopes, eroded, is a phase of the Miami series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Toronto-Millbrook complex, 0 to 2 percent slopes, is an example.

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

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

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

Soil Descriptions

Am—Allison silt loam, protected. This nearly level, very deep, well drained soil is on flood plains. It is protected from flooding by levees and pumps. Individual areas are irregular in shape and range from 3 to 150 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable silt loam and firm silty clay loam about 7 inches thick. The subsoil to a depth of 80 inches or more is firm silty clay loam. It is very dark grayish brown in the upper part and brown in the lower part. In some places the dark surface layer is less than 24 inches thick. In other places free carbonates are throughout the subsoil.

Included with this soil in mapping are the well drained Ross, somewhat poorly drained Tice, and very poorly drained Sawabash soils. Ross soils have more sand in the upper part of the subsoil than the Allison soil. They are in the higher lying areas. Tice and Sawabash soils are in the lower lying areas. Included soils make up about 10 percent of the unit.

The available water capacity is very high in the Allison soil. Permeability is moderate. Surface runoff is

slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops.

This soil is well suited to corn, soybeans, and small grain. Crusting is a management concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of possible flooding as a result of levee failure, this soil is generally unsuitable as a site for dwellings. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for local roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is I. No woodland ordination symbol is assigned.

Ap—Allison silt loam, frequently flooded. This nearly level, very deep, well drained soil is on flood plains. It is subject to frequent flooding for very brief to long periods during the winter and spring. Individual areas are irregular in shape and range from 5 to 250 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is about 48 inches thick. It is very dark grayish brown, firm silt loam in the upper part and very dark grayish brown, very dark gray, and dark brown, firm silty clay loam in the lower part. The subsoil to a depth of 80 inches or more is dark brown, firm silty clay loam. In some places the dark surface layer is less than 24 inches thick. In other places free carbonates are throughout the subsoil.

Included with this soil in mapping are the well drained Du Page, moderately well drained Tice, and very poorly drained Sawabash soils. Du Page soils have more sand in the upper part of the subsoil than the Allison soil. They are in the slightly lower positions. Tice and Sawabash soils are in the lower lying areas. Included soils make up about 10 percent of the unit.

The available water capacity is very high in the Allison soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for woodland, hay, or pasture.

This soil is well suited to corn and soybeans, but damage from floodwaters can be expected. Flooding is the major management concern. Small grain planted in the fall is subject to severe damage during periods of prolonged flooding. Planting in late spring and using short-season varieties of adapted crops help to minimize the damage or loss caused by flooding. Levees and dikes help to control flooding, but they are extremely expensive if properly constructed. Crusting is also a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring chisel, spring moldboard, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops in winter and spring. Levees and dikes help to control flooding. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the flooding, this soil is generally unsuitable for use as a site for dwellings. Because of low strength, the flooding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for local roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and by frost action.

The land capability classification is IIw. No woodland ordination symbol is assigned.

AtB2—Alvin-Spinks complex, 2 to 6 percent slopes, eroded. This map unit consists of gently sloping, very deep, well drained soils in undulating areas on outwash plains, terraces, till plains, and recessional moraines. The Alvin soil is on the lower part of side slopes and on toe slopes. The Spinks soil is on

shoulder slopes and the summits of ridgetops. Individual areas of this unit are elongated or irregularly shaped and range from 2 to 50 acres in size. They are about 50 percent Alvin soil and 35 percent Spinks soil. The two soils occur as areas so intricately mixed or so small that it was not practical to map them separately.

Typically, the surface layer of the Alvin soil is dark brown fine sandy loam. It contains dark brown material from the subsoil. It is about 10 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is dark brown, friable fine sandy loam and sandy loam. The lower part is dark brown, friable loamy sand that has pockets of sandy loam. In a few small areas the lower part of the subsoil and the underlying material have gravelly textures. In a few places the surface layer is darker.

Typically, the surface layer of the Spinks soil is dark brown fine sand. It contains yellowish brown material from the subsurface layer. It is about 8 inches thick. The subsurface layer extends to a depth of 80 inches or more. The upper part is yellowish brown, loose fine sand. The lower part is yellowish brown, loose fine sand that has bands of dark brown loamy fine sand. In places the bands in the subsurface layer are less than 6 inches thick. In a few small areas the surface layer is darker.

Included with these soils in mapping are areas of the somewhat poorly drained Whitaker soils and the very poorly drained Mahalasville and Treaty soils on toe slopes and in depressions. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Alvin soil and low in the Spinks soil. Permeability is moderately rapid in the Alvin soil. It is rapid in the upper part of the solum in the Spinks soil, moderately rapid in the lower part of the solum, and rapid in the underlying material. Surface runoff is medium on both soils. The content of organic matter in the surface layer is low.

Most areas are used for cultivated crops. Many areas are used for hay or pasture or are idle land. A few areas are used as woodland.

These soils are well suited to corn, soybeans, and small grain. Water erosion and soil blowing are hazards, and droughtiness is a limitation. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion and soil blowing, reduce the evaporation rate, and help to maintain tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to no-till and ridge-till tillage systems and to spring chisel systems if the new crop is planted into corn residue.

These soils are well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Water erosion and soil blowing are hazards, and droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control runoff, erosion, and soil blowing. Overgrazing and grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. Plant competition is the main management concern in areas of the Alvin soil. The main management concerns in areas of the Spinks soil are the equipment limitation, seedling mortality, and plant competition. Equipment tends to bog down in sandy soils when they are dry. The equipment limitation can be reduced by delaying timber harvest until the soil is moist or frozen. Competing vegetation can be controlled by spraying, cutting, or girdling. Site preparation, special planting stock, and overplanting help to overcome seedling mortality. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

These soils are suitable as sites for dwellings. Because of the potential for frost action, the Alvin soil is moderately limited as a site for local roads and streets. The Spinks soil is suitable as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIe. The woodland ordination symbol is 4A for the Alvin soil and 4S for the Spinks soil.

Ba—Battleground silt loam, protected. This nearly level, very deep, well drained soil is on flood plains. It is protected from flooding by levees and pumps. Individual areas are irregular in shape and range from 100 to 275 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface

layer also is very dark grayish brown silt loam. It is about 9 inches thick. The subsoil to a depth of 80 inches or more is dark brown, friable silt loam. In some places the dark surface layer is more than 23 inches thick. In other places the surface layer and subsoil do not have free carbonates.

Included with this soil in mapping are the somewhat excessively drained Ouiatenon soils that have a sandy substratum and the somewhat poorly drained Tice soils. Ouiatenon soils are in areas adjacent to stream channels. Tice soils are in the lower lying areas. Included soils make up about 10 percent of the unit.

The available water capacity is very high in the Battleground soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops.

This soil is well suited to corn, soybeans, and small grain. Crusting is a management concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation and plant competition. Rare flooding may hinder harvesting and logging. The equipment limitation can be reduced by delaying timber harvest until dry periods. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of possible flooding as a result of levee failure, this soil is generally unsuitable as a site for dwellings. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for local roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

Bb—Battleground silt loam, frequently flooded. This nearly level, very deep, well drained soil is on flood plains. It is subject to frequent flooding for brief or long periods from fall through spring (fig. 7). Individual areas are irregular in shape and range from 2 to 600 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 9 inches thick. The subsoil to a depth of 80 inches or more is dark brown, friable silty clay loam and silt loam. In some places the dark surface layer is more than 23 inches thick. In other places the surface layer and subsoil do not have free carbonates.

Included with this soil in mapping are the somewhat excessively drained Ouiatenon soils that have a sandy substratum, the well drained Lash soils, the somewhat poorly drained Tice soils, and the very poorly drained Sawabash soils. Ouiatenon and Lash soils are in areas adjacent to stream channels. Lash soils have more sand and less clay in the subsoil than the Battleground soil. Tice and Sawabash soils are in the lower lying areas. Included soils make up about 15 percent of the unit.

The available water capacity is very high in the Battleground soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for woodland, hay, or pasture.

This soil is well suited to corn and soybeans, but damage from floodwaters can be expected. Flooding is the major management concern. Small grain planted in the fall is subject to severe damage during periods of prolonged flooding. Late spring planting of short-season varieties of adapted crops helps to minimize the damage or loss caused by flooding. Levees and dikes help to control flooding, but they are extremely expensive if properly constructed. Crusting is also a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring moldboard, spring chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops in winter and early spring. Levees and dikes help to control flooding. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can

Figure 7.—Flooding on a golf course in an area of Battleground silt loam, frequently flooded.

cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation and plant competition. The frequent flooding can delay planting and harvesting. The equipment limitation can be reduced by delaying timber harvest until dry periods. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, the flooding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for local roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and by frost action.

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

BgA—Beecher silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on recessional moraines. It is deep over compact glacial till. Individual areas are irregular in shape and range from 2 to 60 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is olive brown and light olive brown, mottled, firm silty clay loam about 35 inches thick. The underlying material to a depth of 60 inches or more is light olive brown, mottled silty clay loam. In places the surface layer is more than 10 inches thick. In a few small areas stratified material is above the glacial till. In some places the underlying glacial till is loam.

Included with this soil in mapping are a few small areas of the moderately well drained Marker soils on small rises and in the more sloping areas along drainageways. Also included are small areas of the poorly drained Drummer soils in depressions and drainageways. Included soils make up about 10 percent of the unit.

The available water capacity is high in the Beecher soil. Permeability is slow. Surface runoff also is slow. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1 to 3 feet, mainly in winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major management concern. Crusting is also a problem. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, fall chisel, and ridge-till tillage systems. It is also well suited to no-till if the new crop is planted into soybean residue or in residue-cleared rows.

This soil is well suited to grasses and legumes for hay and pasture. Reed canarygrass and ladino clover are adapted grass species. The wetness is a limitation. A drainage system is necessary for high yields. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concern is the windthrow hazard. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the wetness, this soil is severely limited as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads and streets on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

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

BkF—Berks channery silt loam, 25 to 60 percent slopes. This steep and very steep, well drained soil is on upland hillslopes. It is moderately deep over interbedded siltstone and shale bedrock. Individual areas are long and narrow and range from 2 to 30 acres in size.

Typically, the surface layer is very dark grayish brown channery silt loam about 3 inches thick. The subsurface layer is brown, friable channery silt loam about 5 inches thick. The subsoil is about 21 inches thick. It is light yellowish brown, friable very channery silt loam in the upper part and pale brown, firm channery silt loam in the lower part. Below this to a depth of 60 inches or more is siltstone bedrock. In a few areas the underlying bedrock is at a depth of less than 20 inches or more than 40 inches. In the northeastern part of the county, the bedrock is New Albany shale.

Included with this soil in mapping are the moderately well drained High Gap Variant soils. These soils are on the upper part of side slopes and on ridgetops. Also included are areas of bedrock escarpments. Included areas make up about 15 percent of the unit.

The available water capacity is low in the Berks soil. Permeability is moderate in the upper part of the subsoil and moderately rapid in the lower part. Surface runoff is

very rapid. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used as woodland. A few small areas are used for pasture.

This soil is generally unsuited to cultivated crops and hay. It is poorly suited to pasture. Erosion is a severe hazard. Because of the slope, the use of standard farm machinery is restricted.

This soil is poorly suited to trees. The main management concerns are the hazard of erosion, the equipment limitation, and seedling mortality. Using selective cutting rather than clear cutting, establishing haul roads on the contour, and preserving as much understory vegetation as possible help to control erosion. Special operations, such as yarding logs uphill with cable, may be needed to minimize the use of rubber-tired and crawler tractors. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the slope, this soil is generally unsuitable as a site for dwellings and is severely limited as a site for local roads and streets. Cuts and fills are needed. Where possible, building the roads on the contour helps to overcome the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

BlA—Billett fine sandy loam, gravelly substratum, 0 to 2 percent slopes. This nearly level, well drained soil is on terraces and outwash plains. It is deep over gravelly coarse sand. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 51 inches thick. It is dark brown, friable fine sandy loam in the upper part; dark brown, firm sandy loam and friable fine sandy loam in the next part; and dark brown, very friable loamy sand in the lower part. The underlying material to a depth of 65 inches or more is yellowish brown gravelly coarse sand. In some places the dark surface layer is 10 or more inches thick. In a few small areas the upper part of the subsoil has more clay and gravel. In some places the surface layer is lighter colored.

Included with this soil in mapping are small areas of the well drained Troxel soils in depressions. These soils have more clay and less sand in the subsoil than the Billett soil and have a dark surface layer more than 24 inches thick. Also included are the excessively drained Rodman soils on steep breaks. Included soils make up about 5 percent of the map unit.

The available water capacity is moderate in the Billett soil. Permeability is moderately rapid in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is fairly well suited to corn, soybeans, and small grain. Soil blowing is a hazard, and droughtiness is a limitation. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing, reduce the evaporation rate, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Droughtiness is a limitation, and soil blowing is a hazard. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control soil blowing. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is suitable for use as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIIs. No woodland ordination symbol is assigned.

BlB2—Billett fine sandy loam, gravelly substratum, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on rises and breaks on terraces and outwash plains. It is deep over gravelly coarse sand. Individual areas are irregular in shape and range from 3 to 25 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. It contains dark brown material from the subsoil. The subsoil is 48

inches thick. It is dark brown, friable fine sandy loam and sandy loam in the upper part and dark yellowish brown, very friable loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown gravelly coarse sand. In a few areas, more gravel is in the subsoil or gravelly sand is within a depth of 40 inches. In some places the dark surface layer is more than 10 inches thick. In other places the surface layer is lighter colored.

Included with this soil in mapping are areas of the excessively drained Rodman soils on steep breaks, small areas of severely eroded soils that have a gravelly surface soil and have slopes of more than 6 percent, and areas of the well drained Troxel soils in depressions. Troxel soils have more clay and less sand in the subsoil than the Billett soil and have a dark surface layer more than 24 inches thick. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Billett soil. Permeability is moderately rapid in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture.

This soil is fairly well suited to corn, soybeans, and small grain. Water erosion and soil blowing are hazards, and droughtiness is a limitation. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing and erosion, reduce the evaporation rate, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Water erosion and soil blowing are hazards. Growing grasses and legumes for hay and pasture helps to control runoff, soil blowing, and water erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is suitable as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

BmA—Billett fine sandy loam, moderately wet, 0 to 2 percent slopes. This nearly level, very deep, moderately well drained soil is on till plains and recessional moraines. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil extends to a depth of 80 inches. The upper part is dark yellowish brown and yellowish brown, firm fine sandy loam. The next part is yellowish brown, mottled, friable sandy loam and very friable loamy sand. The lower part is gray, mottled, friable sandy loam that has pockets of loamy sand. In some areas the surface layer is lighter colored. In other areas the dark surface layer is more than 10 inches thick.

Included with this soil in mapping are a few small areas of the somewhat excessively drained Oakville soils on rises. Also included are small areas of the somewhat poorly drained La Hogue soils at the lower elevations. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Billett soil. Permeability is moderately rapid. Surface runoff is slow. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 3 to 6 feet in winter and early spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture.

This soil is fairly well suited to corn, soybeans, and small grain. Soil blowing is a hazard, and droughtiness is a limitation. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by

maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing, reduce the evaporation rate, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Droughtiness is a limitation, and soil blowing is a hazard. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control soil blowing. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

This soil is suitable as a site for dwellings without basements. The wetness is a moderate limitation on sites for dwellings with basements. Installing subsurface drains helps to lower the water table. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

BnA—Billett loam, gravelly substratum, 0 to 2 percent slopes. This nearly level, well drained soil is on terraces and outwash plains. It is deep over gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 900 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 47 inches thick. It is dark brown, friable loam in the upper part; dark brown, friable sandy loam in the next part; and dark brown, very friable loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown gravelly coarse sand. In some places the dark surface layer is 10 or more inches thick. In a few small areas the upper part of the subsoil has less sand. In places the surface layer is lighter colored.

Included with this soil in mapping are small areas of the well drained Troxel soils in depressions. These soils have more clay and less sand in the subsoil than the Billett soil and have a dark surface layer more than 24 inches thick. Also included are the excessively drained Rodman soils on steep breaks. Included soils make up about 5 percent of the unit.

The available water capacity is moderate in the Billett soil. Permeability is moderately rapid in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is fairly well suited to corn, soybeans, and small grain. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Crusting is also a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops and green manure crops help to minimize crusting and evaporation and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is suitable as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIIs. No woodland ordination symbol is assigned.

BnB2—Billett loam, gravelly substratum, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on breaks and along drainageways on terraces and outwash plains. It is deep over gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is very dark grayish

brown loam about 9 inches thick. It contains dark brown material from the subsoil. The subsoil is 37 inches thick. It is dark brown, firm loam in the upper part; dark brown, friable sandy loam in the next part; and dark brown, very friable loamy sand in the lower part. The underlying material to a depth of 60 inches or more is brown gravelly coarse sand. In a few areas, the subsoil has more gravel or gravelly coarse sand is within a depth of 40 inches. In places the dark surface layer is more than 10 inches thick. In a few areas the surface layer is lighter colored.

Included with this soil in mapping are areas of the excessively drained Rodman soils on steep breaks and small areas of severely eroded soils that have a gravelly surface soil and have slopes of more than 6 percent. Also included are the well drained Troxel soils in depressions. Troxel soils have more clay and less sand in the subsoil than the Billett soil and have a dark surface layer more than 24 inches thick. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Billett soil. Permeability is moderately rapid in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is a hazard, and droughtiness is a limitation. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, a system of conservation tillage that leaves a protective cover of crop residue on the surface, cover crops, green manure crops, grade-stabilization structures, critical-area plantings, and crop rotations. Grassed waterways help to control erosion in the drainageways. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, minimize crusting and evaporation, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and spring chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes for hay and pasture helps to control runoff and erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is suitable as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

BoA—Bowes silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on outwash plains. It is deep or very deep over gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 180 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 47 inches thick. It is dark brown and dark yellowish brown, firm silt loam and silty clay loam in the upper part; dark yellowish brown, firm clay loam, firm sandy clay loam, friable fine sandy loam, and very friable fine sand in the next part; and dark brown, firm gravelly sandy clay loam in the lower part. The underlying material to a depth of 60 inches or more is dark yellowish brown gravelly coarse sand. In places the dark surface layer is 10 or more inches thick. In a few areas the upper part of the subsoil has more sand. In some places the surface layer is lighter colored.

Included with this soil in mapping are small areas of the moderately well drained Bowes Variant and somewhat poorly drained Lafayette soils in the slightly lower positions in the landscape. Also included, in depressions, are the very poorly drained Mahalasville soils that have a gravelly substratum. Included soils make up about 12 percent of the unit.

The available water capacity is high in the Bowes soil. Permeability is moderate in the upper part of the subsoil, moderately rapid in the lower part of the subsoil, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Crusting is a management concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve

tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations and footings should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is I. No woodland ordination symbol is assigned.

BpA—Bowes Variant silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on outwash plains. It is deep or very deep over gravelly sand. Individual areas are irregular in shape and range from 2 to 25 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is about 44 inches thick. The upper part is dark brown and dark yellowish brown, firm silt loam, silty clay loam, and clay loam; the next part is dark yellowish brown, mottled, firm loam; and the lower part is dark brown, mottled gravelly sandy loam. The underlying material to a depth of 60 inches or more is brown gravelly sand. In some places the dark surface layer is 10 or more inches thick. In some areas the surface layer is lighter colored.

Included with this soil in mapping are small areas of the somewhat poorly drained Lafayette soils at the slightly lower elevations and the well drained Bowes soils in the slightly higher areas. Also included, in slight depressions, are the very poorly drained Mahalasville soils that have a gravelly substratum. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Bowes Variant soil. Permeability is moderate in the upper part of the subsoil, moderately rapid in the lower part of the subsoil, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate. The water table is at a depth of 2 to 6 feet in winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture.

This soil is well suited to corn, soybeans, and small grain. Crusting is a management concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Wetness and the shrink-swell potential are moderate limitations if this soil is used as a site for dwellings without basements. The wetness is a severe limitation on sites for dwellings with basements. Foundations and footings should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Installing subsurface drains helps to lower the water table. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is I. No woodland ordination symbol is assigned.

CaA—Camden silt loam, 0 to 2 percent slopes. This nearly level, very deep, well drained soil is on till plains. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 55 inches thick. It is dark yellowish brown, firm silt loam and silty clay loam in the upper part; dark brown, firm loam, friable sandy loam, and friable fine sandy loam in the next part; and dark yellowish brown, friable loam in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown loam that has strata of sandy loam. In places the surface layer is darker. In a few small areas, loam glacial till is at a depth of less than 60 inches. In some places the upper part of the subsoil has more sand. In other places the depth to the

underlying material is more than 65 inches.

Included with this soil in mapping are the somewhat poorly drained Fincastle and Starks soils in the slightly lower positions in drainageways and in depressions. Also included are areas of the moderately well drained Rockfield soils at the slightly lower elevations. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Camden soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Crusting is a management concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings without basements. The soil is suitable as a site for dwellings with basements. Foundations and footings should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is I. The woodland ordination symbol is 7A.

CfB—Carmi sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on rises and breaks on terraces and outwash plains. It is deep over sand and very gravelly coarse sand. Individual areas are elongated or irregularly shaped and range from 2 to 200 acres in size.

Typically, the surface layer is very dark gray sandy loam about 10 inches thick. The subsurface layer is very dark gray, friable sandy loam about 3 inches thick. The subsoil is about 32 inches thick. It is dark brown, friable sandy loam and gravelly sandy loam in the upper part; dark brown, friable very gravelly sandy loam in the next part; and dark brown, very friable very gravelly loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, stratified sand and very gravelly coarse sand. In some places, the upper part of the subsoil has more gravel or the lower part of the subsoil has less gravel. In a few areas the surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of the well drained Desker soils in the more sloping areas. These soils have a solum that is less than 40 inches thick. Also included are the well drained Troxel and excessively drained Sparta soils. Troxel soils are in depressions. They have more clay and less sand in the subsoil than the Carmi soil and have a dark surface layer more than 24 inches thick. Sparta soils are in positions on the landscape similar to those of the Carmi soil. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Carmi soil. Permeability is moderately rapid in the solum and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Water erosion and soil blowing are hazards. Droughtiness is a limitation. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion and soil blowing, reduce the evaporation rate, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-

till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Water erosion and soil blowing are hazards, and droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control runoff, soil blowing, and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is suitable as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIe. No woodland ordination symbol is assigned.

CgA—Carmi loam, 0 to 2 percent slopes. This nearly level, well drained soil is on terraces. It is deep over very gravelly coarse sand. Individual areas are irregular in shape and range from 3 to 800 acres in size.

Typically, the surface layer is very dark gray loam about 11 inches thick. The subsurface layer is very dark gray and very dark grayish brown, friable loam about 9 inches thick. The subsoil is about 34 inches thick. It is dark brown, friable loam in the upper part; dark brown, friable gravelly loam and gravelly sandy loam in the next part; and dark brown, very friable gravelly loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown very gravelly coarse sand. In some areas the dark surface layer is less than 10 inches thick. In places the upper part of the subsoil has more clay and gravel. In some small areas the underlying very gravelly coarse sand is at a depth of less than 40 inches.

Included with this soil in mapping are areas of the well drained Troxel soils in depressions. These soils have more clay and less sand in the subsoil than the Carmi soil and have a dark surface layer more than 24 inches thick. Also included are the excessively drained Sparta soils on rises. Included soils make up about 10 percent of the unit.

The available water capacity is moderate in the Carmi soil. Permeability is moderately rapid in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Droughtiness is a limitation. Crusting is also a concern. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops minimize crusting and evaporation and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is suitable as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIs. No woodland ordination symbol is assigned.

Ck—Ceresco sandy loam, gravelly substratum, rarely flooded. This nearly level, somewhat poorly drained soil is on flood plains. It is moderately deep or deep over gravelly sand. It is subject to rare flooding for brief periods during the winter and spring. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable sandy loam about 6 inches thick. The subsoil is about 24 inches thick. It is dark brown, mottled, friable sandy loam in the upper part and dark yellowish brown, mottled, friable fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is dark brown, mottled gravelly sand. In places the subsoil has more clay. In a few areas the underlying material does not contain gravel. In some areas the surface layer is lighter colored. In other areas free carbonates are throughout the surface layer and subsoil.

Included with this soil in mapping are the somewhat

excessively drained Ouiatenon soils in areas adjacent to stream channels. Also included are the very poorly drained Cohoctah soils at the slightly lower elevations and in areas adjacent to uplands. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Ceresco soil. Permeability is moderately rapid in the solum and very rapid in the underlying material. Surface runoff is very slow. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1 to 2 feet during the winter and spring.

Most areas of this soil are used for cultivated crops. Some areas are used for woodland, hay, or pasture.

This soil is well suited to corn, soybeans, and small grain. Wetness and soil blowing are the major management concerns. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till if the new crop is planted into soybean residue or in residue-cleared rows. It is also well suited to spring moldboard and spring chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation, and soil blowing is a hazard. Subsurface drains can be used to remove excess water if adequate outlets are available. Growing grasses and legumes helps to control soil blowing. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation and plant competition. The rare flooding may hinder harvesting and logging. The equipment limitation can be reduced by delaying timber harvest until dry periods. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding and the wetness, this soil is generally unsuitable as a site for dwellings. Because of the potential for frost action, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

Cl—Ceresco loam, gravelly substratum, occasionally flooded. This nearly level, somewhat poorly drained soil is on flood plains. It is moderately deep or deep over gravelly sand and very gravelly sand. It is subject to occasional flooding for brief periods during the winter and spring. Individual areas are long and narrow and range from 2 to 80 acres in size.

Typically, the surface layer is very dark gray loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable loam about 3 inches thick. The subsoil is friable fine sandy loam about 18 inches thick. It is mottled. The upper part is dark yellowish brown, and the lower part is dark grayish brown. The underlying material to a depth of 60 inches or more is grayish brown gravelly sand and very gravelly sand. In places the subsoil has more clay. In a few areas the underlying material does not contain gravel. In some areas the surface layer is lighter colored. In other areas free carbonates are throughout the surface layer and subsoil.

Included with this soil in mapping are the somewhat excessively drained Ouiatenon soils in areas adjacent to stream channels. Also included are the very poorly drained Cohoctah soils at the slightly lower elevations and in areas adjacent to uplands. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Ceresco soil. Permeability is moderately rapid in the solum and very rapid in the underlying material. Surface runoff is very slow. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1 to 2 feet during the winter and spring.

Most areas of this soil are used for cultivated crops. Some areas are used for woodland, hay, or pasture.

This soil is well suited to corn and soybeans, but damage from floodwaters can be expected. Wetness and the flooding are the major management concerns. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Small grain seeded in the fall is subject to severe damage during periods of prolonged flooding. Late spring planting of short-season varieties of adapted crops helps to minimize damage or loss caused by flooding. Dikes or levees can be used to protect some areas from flooding, but they are extremely expensive if properly constructed. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover

crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring moldboard, spring chisel, and no-till tillage systems if the new crop is planted in residue-cleared rows.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops in winter and spring. Wetness is a limitation, and flooding is a hazard. Subsurface drains can be used to remove excess water if adequate outlets are available. Some areas can be protected from flooding by levees or dikes. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation and plant competition. The flooding can delay planting and harvesting. The equipment limitation can be reduced by delaying timber harvest until dry periods. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding and the wetness, this soil is generally unsuited to use as a site for dwellings. Because of the flooding and the potential for frost action, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and by frost action.

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

Cm—Chalmers silty clay loam. This nearly level, poorly drained soil is in depressions and drainageways on till plains. It is deep over compact glacial till. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 3 to 180 acres in size.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is black, firm silty clay loam about 4 inches thick. The subsoil is about 32 inches thick. It is grayish brown, mottled, firm silty clay loam in the upper part and grayish brown, mottled, firm clay loam and loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, mottled loam. In a few small areas, stratified material is above the underlying loam glacial till. In some areas the soil has more than 40 inches of silty material. In places the underlying glacial till is fine sandy loam.

Included with this soil in mapping are the somewhat poorly drained Toronto and Millbrook soils. These soils are in the slightly higher positions on the landscape. They make up about 10 percent of the unit.

The available water capacity is high in the Chalmers soil. Permeability is moderate in the solum and moderately slow in the underlying material. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface, mainly during the winter and spring. The surface layer becomes cloddy and difficult to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Wetness and the ponding are the major management concerns. Crusting is also a concern. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to fall moldboard, fall chisel, and ridge-till tillage systems. It is also well suited to no-till if the new crop is planted into soybean residue or in residue-cleared rows.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the ponding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, the ponding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill

material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IIw. No woodland ordination symbol is assigned.

Co—Cohoctah fine sandy loam, gravelly substratum, rarely flooded. This nearly level, very poorly drained soil is on flood plains. It is moderately deep or deep over sand and gravelly sand. It is subject to rare flooding for brief periods during the winter and spring. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is very dark gray fine sandy loam about 10 inches thick. The subsurface layer is very dark gray, firm fine sandy loam about 3 inches thick. The subsoil is about 19 inches thick. It is dark grayish brown, mottled, firm fine sandy loam in the upper part and grayish brown, mottled, friable fine sandy loam and very friable loamy fine sand in the lower part. The underlying material to a depth of 60 inches or more is grayish brown, mottled loamy sand, sand, and gravelly sand. In a few areas the soil has a lighter colored overwash of silt loam or loam that is 7 to 20 inches thick. In places the depth to calcareous gravelly material is more than 60 inches. In some areas the upper part of the subsoil has less sand and more clay. In a few places, glacial till is within a depth of 60 inches and the layer of gravelly material is thin.

Included with this soil in mapping are the somewhat excessively drained Ouiatenon and somewhat poorly drained Ceresco soils at the slightly lower elevations adjacent to stream channels. These soils make up about 15 percent of the unit.

The available water capacity is moderate in the Cohoctah soil. Permeability is moderately rapid in the solum and very rapid in the underlying material. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is moderate. The water table is at or above the surface, mainly during the winter and spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Wetness, the ponding, and the hazard of soil blowing are the major management concerns. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Diverting runoff from nearby upland areas helps to minimize the ponding. Springs at the base of the steep breaks should be cut off with subsurface drains or diversions. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring moldboard, spring chisel, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. The wetness, the ponding, and the hazard of soil blowing are management concerns. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Growing grasses and legumes helps to control soil blowing. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during seasons of the year when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding and the flooding, this soil is generally unsuitable as a site for dwellings. Because of the ponding and the potential for frost action, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Cp—Cohoctah loam, gravelly substratum, occasionally flooded. This nearly level, very poorly drained soil is on flood plains. It is moderately deep or deep over sand and very gravelly sand. It is subject to occasional flooding for brief periods during the winter and spring. It is frequently ponded by surface runoff

from adjacent areas. Individual areas are irregular in shape and range from 2 to 350 acres in size.

Typically, the surface layer is black loam about 10 inches thick. The subsurface layer is very dark gray and very dark grayish brown, mottled, friable fine sandy loam about 10 inches thick. The subsoil is about 25 inches thick. It is dark grayish brown, mottled, friable sandy loam in the upper part and grayish brown, mottled, very friable loamy sand in the lower part. The underlying material to a depth of 60 inches or more is grayish brown, mottled, stratified sand and very gravelly sand. In a few areas the soil has a lighter colored overwash of silt loam or loam that is 7 to 20 inches thick. In some places the dark surface layer is 24 or more inches thick. In other places the underlying material does not contain gravel. In some areas the upper part of the subsoil has less sand and more clay.

Included with this soil in mapping are a few small areas of the somewhat excessively drained Ouiatenon and somewhat poorly drained Ceresco soils in the slightly higher elevations adjacent to stream channels. These soils make up about 15 percent of the unit.

The available water capacity is moderate in the Cohoctah soil. Permeability is moderately rapid in the solum and very rapid in the underlying material. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is moderate. The water table is at or above the surface, mainly during the winter and spring.

Most areas of this soil are used as woodland or for cultivated crops. A few areas are used for hay or pasture.

This soil is fairly well suited to corn and soybeans, but damage from floodwater can be expected. Wetness, ponding, and flooding are the major management concerns. Crusting is also a concern. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Levees or dikes help to control flooding, but they are extremely expensive if properly constructed. Diverting runoff from nearby upland areas helps to minimize the ponding. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Springs at the base of steep breaks should be cut off with subsurface drains or diversions. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring chisel and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and alfalfa, for hay and pasture, but prolonged flooding can damage these crops in winter and spring. Wetness, ponding, and flooding are management concerns. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Some areas of this soil can be protected from flooding by levees or dikes. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. The flooding can delay planting and harvesting. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding and the flooding, this soil is generally unsuitable as a site for dwellings. Because of the flooding, the ponding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and ponding and by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

CrC—Coloma sand, 6 to 15 percent slopes. This moderately sloping and strongly sloping, very deep, somewhat excessively drained soil is in undulating areas on outwash plains and terraces. Individual areas are elongated or irregularly shaped and range from 2 to 120 acres in size.

Typically, the surface layer is dark brown sand about 8 inches thick. The subsurface layer extends to a depth of 80 inches or more. The upper part is yellowish brown, very friable sand. The lower part is yellowish brown, loose sand that has dark brown bands of very friable loamy sand. In some places the lower part of the subsoil has more clay and gravel. In a few small areas the subsurface layer does not have bands of loamy

sand. In a few places the surface layer is darker.

Included with this soil in mapping are areas of steeper soils. Also included, in the more level areas, are the well drained Elston soils and Billett soils that have a gravelly substratum. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Coloma soil. Permeability is rapid. Surface runoff is medium. The content of organic matter in the surface layer is low.

Most areas of this soil are idle land. Some areas are used for cultivated crops or for hay, pasture, or woodland.

This soil is generally unsuited to cultivated crops. Soil blowing is a hazard, and droughtiness is a limitation.

This soil is poorly suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay. It is fairly well suited to pasture. Soil blowing is a hazard, and the slope and droughtiness are limitations. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control soil blowing. Overgrazing reduces plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation and seedling mortality. Equipment tends to bog down in sandy soils when they are dry. The equipment limitation can be reduced by delaying timber harvest until the soil is moist or frozen. Site preparation, special planting stock, and overplanting help to overcome seedling mortality. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The slope is a moderate limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. The slope is also a moderate limitation on sites for local roads and streets. Where possible, constructing the roads on the contour reduces the amount of land grading needed to overcome the slope.

The land capability classification is VIs. The woodland ordination symbol is 4S.

CtA—Crosby silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on till plains. It is moderately deep over compact glacial till. Individual areas are irregular in shape and range from 2 to more than 1,000 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 20 inches thick. It is dark yellowish brown, mottled, firm clay loam in the upper part and yellowish brown, mottled, firm loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, mottled loam. In places the surface layer is darker. In some areas the upper part of the subsoil contains less sand. In a few places compact glacial till is within a depth of 26 inches.

Included with this soil in mapping are the somewhat poorly drained Fincastle soils in the slightly lower positions. These soils have less sand in the upper part of the subsoil than the Crosby soil. Also included are small areas of the well drained Miami soils on slight rises and in the more sloping areas along drainageways and small areas of the very poorly drained Mahalasville and Treaty soils in depressions and drainageways. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Crosby soil. Permeability is slow. Surface runoff also is slow. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 1 to 3 feet in winter and spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, fall chisel, and ridge-till tillage systems. It also is well suited to no-till if the new crop is planted into soybean residue or in residue-cleared rows.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness is a severe limitation if this soil is used as a site for dwellings. Installing subsurface drains

helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

CwB2—Crosby-Miami complex, 2 to 6 percent slopes, eroded. This map unit consists of gently sloping soils on rises and along drainageways on till plains and recessional moraines. These soils are moderately deep over compact glacial till. The Crosby soil is somewhat poorly drained and is on toe slopes, in drainageways, and on the less sloping part of side slopes. The Miami soil is well drained and is on knolls, shoulder slopes, and the more sloping part of side slopes. Individual areas of this unit are irregular in shape and range from 2 to 300 acres in size. They are about 50 percent Crosby soil and 35 percent Miami soil. The two soils occur as areas so intricately mixed or so small that it was not practical to map them separately.

Typically, the surface layer of the Crosby soil is brown silt loam about 9 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is about 22 inches thick. The upper part is dark yellowish brown, mottled, firm silty clay loam, and the lower part is dark yellowish brown and yellowish brown, mottled, firm clay loam and loam. The underlying material to a depth of 60 inches or more is yellowish brown, mottled loam. In a few places the soil has more than 18 inches of silty material. In some areas the depth to compact glacial till is more than 40 inches or less than 26 inches. In a few areas a thin layer of stratified material is above the glacial till. In a few places the glacial till is fine sandy loam. In some areas the surface layer is darker.

Typically, the surface layer of the Miami soil is brown silt loam about 9 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is about 27 inches thick. It is dark yellowish brown, firm clay loam and loam in the upper part and dark yellowish brown, firm sandy clay loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown fine sandy loam. In a few places the depth to compact glacial till is less than 24 inches. In some areas the subsoil has more gravel or more sand. In places the surface layer is darker.

Included with these soils in mapping are the very poorly drained Mahalasville and Treaty soils in depressions and drainageways and the somewhat poorly drained Fincastle and Starks soils in landscape positions similar to those of the Crosby soil. Fincastle and Starks soils have less sand in the upper part of the subsoil than the Crosby soil. Also included are the well drained Richardville soils and severely eroded areas that have a surface soil of silty clay loam or clay loam. Richardville soils are in positions on the landscape similar to those of the Miami soil. They have a solum that is more than 40 inches thick. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Crosby and Miami soils. Permeability is slow in the Crosby soil. It is moderate in the upper part of the subsoil in the Miami soil, moderately slow in the lower part of the subsoil, and slow in the underlying material. Surface runoff is medium on both soils. The content of organic matter in the surface layer is moderately low. The Crosby soil has a water table at a depth of 1 to 3 feet in winter and early spring.

Most areas are used for cultivated crops. Some areas are used for hay or pasture, and a few small areas are used as woodland.

These soils are well suited to corn, soybeans, and small grain. Erosion is a hazard. Wetness is a limitation in areas of the Crosby soil. Crusting is also a concern. Subsurface drains can be used to remove excess water in some areas on toe slopes and in drainageways. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to no-till and ridge-till tillage systems. They are also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Erosion is a hazard. Wetness is a limitation in areas of the Crosby soil. Subsurface drains are needed in some areas on toe slopes and in drainageways. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soils are too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use

during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness is a severe limitation if the Crosby soil is used as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. The shrink-swell potential is a moderate limitation if the Miami soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength, both soils are severely limited as sites for local roads and streets. The potential for frost action is an additional limitation in areas of the Crosby soil. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soils to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIe. The woodland ordination symbol is 4A for the Crosby soil and 5A for the Miami soil.

DmC2—Desker gravelly sandy loam, 6 to 12 percent slopes, eroded. This moderately sloping, well drained soil is on terrace breaks and along drainageways on terraces and outwash plains. It is moderately deep over very gravelly coarse sand. Individual areas are long and narrow or irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is dark brown gravelly sandy loam about 8 inches thick. It contains dark brown material from the subsoil. The subsoil is 19 inches thick. It is dark brown, firm gravelly sandy loam in the upper part and dark brown, friable gravelly coarse sandy loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown very gravelly coarse sand. In places very gravelly sand is at a depth of less than 20 inches or more than 40 inches. In a few areas the surface layer is lighter colored. In some places the dark surface layer is more than 10 inches thick.

Included with this soil in mapping are the well drained Carmi soils on the upper part of side slopes. These soils have a solum that is more than 40 inches thick. Also included are the excessively drained Rodman soils on steep breaks, areas of soils that have a cobbly surface layer, and small severely eroded areas that have a surface soil of gravelly sandy clay loam or gravelly clay loam. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Desker soil. Permeability is moderately rapid in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low. The gravelly surface layer hinders tillage.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion and droughtiness are the major management concerns. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems and to spring chisel systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

The slope is a moderate limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Because of the slope and the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage. Where possible, constructing the roads on the contour reduces the amount of land grading needed to overcome the slope.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

DoC2—Desker sandy loam, kame, 6 to 12 percent slopes, eroded. This moderately sloping, well drained soil is on eskers and kames. It is moderately deep over sand and gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. It contains dark brown material mixed from the subsoil. The subsoil is 25 inches thick. It is dark brown, friable gravelly sandy loam and friable gravelly coarse sandy loam in the upper part and dark yellowish brown, very friable gravelly loamy coarse sand in the lower part. The underlying material to a depth of 60 inches or more is brown, stratified sand and gravelly coarse sand. In some places glacial till is at a depth of less than 60 inches. In a few areas thin strata ranging from silt loam to sandy loam are in the underlying material. In places the surface layer is silt loam. In some areas, the surface layer is lighter colored or the dark surface layer is 10 or more inches thick.

Included with this soil in mapping are areas of the excessively drained Rodman and well drained Longlois soils. Rodman soils are on shoulder slopes. Longlois soils are on toe slopes. They have more clay in the upper part of the subsoil than the Desker soil and have a solum that is more than 40 inches thick. Also included are small severely eroded areas that have a gravelly surface soil. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Desker soil. Permeability is moderately rapid in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Water erosion and soil blowing are major hazards, and droughtiness is the major limitation. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing and erosion, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems and to spring chisel if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Water erosion and soil blowing are hazards. Growing grasses and legumes helps to control runoff, soil blowing, and erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

The slope is a moderate limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Because of the slope and the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage. Where possible, constructing the roads on the contour reduces the amount of land grading needed to overcome the slope.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

DpD2—Desker-Rodman complex, kame, 12 to 18 percent slopes, eroded. This map unit consists of strongly sloping soils on eskers, kames, and terraces. The Desker soil is well drained and is on the lower part of slopes. It is moderately deep over sand and gravelly coarse sand. The Rodman soil is excessively drained and is on the shoulders and summits of ridgetops. It is shallow over very gravelly coarse sand and coarse sand. Individual areas of this unit are long and narrow or irregularly shaped and range from 2 to 120 acres in size. They are about 50 percent Desker soil and 30 percent Rodman soil. The two soils occur as areas so intricately mixed that it was not practical to map them separately.

Typically, the surface layer of the Desker soil is very dark grayish brown sandy loam about 9 inches thick. It contains dark brown material from the subsoil. The subsoil is 21 inches thick. It is dark brown, friable

gravelly sandy loam and gravelly coarse sandy loam in the upper part and dark brown, very friable gravelly loamy coarse sand in the lower part. The underlying material to a depth of 60 inches or more is brown, stratified sand and gravelly coarse sand. In a few areas the surface layer is silt loam. In a few places the underlying material has thin strata ranging from silt loam to sandy loam. In places, the surface layer is lighter colored or the dark surface layer is more than 10 inches thick.

Typically, the surface layer of the Rodman soil is very dark grayish brown gravelly sandy loam about 8 inches thick. The subsurface layer is dark brown, very friable gravelly loamy coarse sand about 4 inches thick. The underlying material to a depth of 60 inches or more is brown very gravelly coarse sand that has strata of coarse sand. In a few areas the underlying material is below a depth of 15 inches. In places the surface layer is lighter colored.

Included with these soils in mapping are the well drained Longlois soils on the lower part of side slopes. Longlois soils have more clay in the upper part of the subsoil than the major soils and have a solum that is more than 40 inches thick. Also included are areas of soils that have a very gravelly or cobbly surface layer. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Desker soil and very low in the Rodman soil. Permeability is moderately rapid in the upper part of the solum in the Desker soil, rapid in the lower part of the solum, and very rapid in the underlying material. It is very rapid in the Rodman soil. Surface runoff is rapid on both soils. The content of organic matter in the surface layer is moderately low.

Most areas are used for cultivated crops. Many areas are used for hay or pasture. A few areas are used as woodland.

These soils are poorly suited to corn, soybeans, and small grain. Erosion and droughtiness are the major management concerns. Soil blowing is also a hazard in areas of the Desker soil. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing and erosion and maintain or improve tilth, infiltration, aeration, and the content of organic matter.

These soils are well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for pasture. They are fairly well suited to hay. Water erosion is a hazard. Soil blowing is an additional concern in areas of the Desker soil. Growing grasses and legumes helps to control runoff, soil blowing, and erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soils are too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

The Rodman soil is well suited to trees. The main management concern is seedling mortality. Site preparation, special planting stock, and overplanting help to overcome seedling mortality. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the slope, these soils are generally unsuited to use as sites for dwellings. The buildings should be designed so that they conform to the natural slope of the land. The slope is a severe limitation if the soils are used as sites for local roads and streets. Cuts and fills are needed. Where possible, constructing the roads on the contour helps to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol for the Rodman soil is 4S. No woodland ordination symbol is assigned for the Desker soil.

Du—Drummer soils. These nearly level, very deep, poorly drained soils are in depressions and drainageways on recessional moraines and till plains. They are frequently ponded by surface runoff from adjacent areas. Individual areas of this unit are irregular in shape and range from 2 to more than 1,000 acres in size. They are about 60 percent Drummer soil and 25 percent Drummer soil that has a stratified sandy substratum.

Typically, the surface layer of the Drummer soil is black silty clay loam about 9 inches thick. The subsurface layer is black, firm silty clay loam about 8 inches thick. It is mottled in the lower part. The subsoil is about 53 inches thick. The upper part is grayish brown and light brownish gray, mottled, firm silty clay loam, and the lower part is yellowish brown, mottled, firm silt loam and clay loam. The underlying material to a depth of 80 inches or more is yellowish brown,

mottled loam that has strata of silty clay loam. In places the subsoil contains more clay. In some areas the thickness of the silty material is less than 40 inches or more than 60 inches. In a few small areas, loam or silt loam glacial till is within a depth of 60 inches.

Typically, the surface layer of the Drummer soil that has a stratified sandy substratum is black silty clay loam about 11 inches thick. The subsoil is about 47 inches thick. It is dark gray, firm silty clay loam in the upper part; olive gray, mottled, firm silty clay loam in the next part; and olive gray, mottled, friable sandy loam in the lower part. The underlying material to a depth of 70 inches or more is olive brown, mottled, stratified fine sand and fine sandy loam. In places the subsoil contains more clay. In some areas the thickness of the silty material is less than 40 inches or more than 60 inches. In a few small areas, loam or silt loam glacial till is within a depth of 60 inches.

Included with these soils in mapping are the somewhat poorly drained Brenton, Millbrook, Raub, and Toronto soils. These included soils are in the slightly higher positions on the landscape. They make up about 15 percent of the unit.

The available water capacity is very high in the Drummer soil and high in the Drummer soil that has a stratified sandy substratum. Permeability is moderate in both soils. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface during the winter and spring. The surface layer of both soils becomes cloddy and hard to work if tilled when too wet.

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

These soils are well suited to corn, soybeans, and small grain. Wetness and the ponding are the major management concerns. Crusting is also a concern. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available (fig. 8). Small enclosed depressions can be drained within open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve soil tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to fall moldboard, fall chisel, and ridge-till tillage systems. They are also well suited to no-till if the new crop is planted into soybean residue.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. The wetness and the ponding are concerns. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soils are too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the ponding, these soils are generally unsuited to use as sites for dwellings. Because of low strength, the ponding, and the potential for frost action, the soils are severely limited as sites for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soils to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IIw. No woodland ordination symbol is assigned.

Dy—Du Page loam, frequently flooded. This nearly level, very deep, well drained soil is on flood plains. It is subject to frequent flooding for very brief to long periods during the winter and spring. Individual areas are irregular in shape and range from 5 to 180 acres in size.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsurface layer is very dark grayish brown and very dark gray, friable loam about 39 inches thick. The underlying material to a depth of 60 inches or more is dark brown sandy loam. In some places the dark surface layer is less than 24 inches thick. In other places the surface layer is silty clay loam or sandy loam. In some areas the underlying material is gravelly sand. In a few areas the surface soil is not calcareous.

Included with this soil in mapping are the well drained Allison and Battleground soils, the somewhat poorly drained Tice soils, and the very poorly drained Sawabash soils in the lower lying areas. Allison and Battleground soils have less sand in the subsoil than the Du Page soil. Included soils make up about 10 percent of the unit.

The available water capacity is high in the Du Page soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for woodland, hay, or pasture.

This soil is well suited to corn and soybeans, but damage from floodwaters can be expected. Flooding is the major management concern. Small grain planted in the fall is subject to severe damage during periods of prolonged flooding. Late spring planting of short-season

Figure 8.—An open ditch helps to overcome wetness in this area of Drummer soils by providing an outlet for subsurface drains and shallow surface drains.

varieties of adapted crops helps to minimize the damage or loss caused by flooding. Levees and dikes help to control flooding, but they are extremely expensive if properly constructed. Crusting is also a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring moldboard, spring chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops in winter and spring. Levees and dikes help to control flooding. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the flooding, this soil is generally unsuited to use as a site for dwellings. The flooding is also a severe limitation on sites for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side

ditches and culverts help to prevent flood damage.

The land capability classification is IIw. No woodland ordination symbol is assigned.

EkA—Elston sandy loam, gravelly substratum, 0 to 2 percent slopes. This nearly level, well drained soil is on terraces and outwash plains. It is deep or very deep over coarse sand and very gravelly coarse sand. Individual areas are irregular in shape and range from 3 to more than 1,000 acres in size.

Typically, the surface layer is very dark gray sandy loam about 10 inches thick. The subsurface layer is very dark gray, friable sandy loam about 4 inches thick. The subsoil is about 35 inches thick. It is dark brown, friable sandy loam in the upper part and dark brown, very friable loamy coarse sand and sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, stratified coarse sand and very gravelly coarse sand. In some places the dark surface layer is less than 10 inches thick. In a few small areas the subsoil contains more gravel or more clay. In some places the surface layer is loamy sand or loam. In some small areas the underlying coarse sand and gravelly coarse sand are at a depth of less than 40 inches.

Included with this soil in mapping are small areas of the well drained Troxel soils in depressions. These soils have more clay and less sand in the subsoil than the Elston soil and have a dark surface layer more than 24 inches thick. Also included are the excessively drained Sparta soils on rises. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Elston soil. Permeability is moderately rapid in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Soil blowing and droughtiness are the major management concerns. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing, minimize crusting and evaporation, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to fall moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Soil blowing and droughtiness are concerns. Growing grasses and legumes helps to control soil blowing. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is suited to use as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIs. No woodland ordination symbol is assigned.

EmA—Elston loam, gravelly substratum, 0 to 2 percent slopes. This nearly level, well drained soil is on terraces and outwash plains. It is deep or very deep over gravelly sand. Individual areas are irregular in shape and range from 3 to more than 1,000 acres in size.

Typically, the surface layer is very dark brown loam about 9 inches thick. The subsurface layer is very dark grayish brown, friable loam about 5 inches thick. The subsoil is about 44 inches thick. It is dark yellowish brown and dark brown, friable loam and sandy loam in the upper part and dark brown, very friable loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown gravelly sand. In some areas the dark surface layer is less than 10 inches thick. In places the subsoil contains more clay and gravel. In some small areas the underlying gravelly sand is at a depth of less than 40 inches. In a few small areas the surface layer is sandy loam.

Included with this soil in mapping are areas of the well drained Troxel soils in depressions. These soils have more clay and less sand in the subsoil than the Elston soil and have a dark surface layer more than 24 inches thick. Also included are the excessively drained Sparta soils on rises. Included soils make up about 5 percent of the unit.

The available water capacity is moderate in the Elston soil. Permeability is moderately rapid in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter

in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Droughtiness is a limitation. Crusting is also a concern. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops minimize crusting, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is suited to use as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIs. No woodland ordination symbol is assigned.

FcB—Fincastle-Crosby complex, 1 to 3 percent slopes. This map unit consists of nearly level and gently sloping, somewhat poorly drained soils on till plains. The Fincastle soil is generally in the more level areas. It is deep over compact glacial till. The Crosby soil is on the higher lying swells and in the more sloping areas along drainageways. It is moderately deep over compact glacial till. Individual areas of this unit are irregular in shape and range from 3 to more than 1,000 acres in size. They are about 55 percent Fincastle soil and 30 percent Crosby soil. The two soils occur as areas so intricately mixed that it was not practical to map them separately.

Typically, the surface layer of the Fincastle soil is dark brown silt loam about 8 inches thick. The subsoil is about 34 inches thick. It is brown and grayish brown, mottled, firm silty clay loam in the upper part and light brownish gray, mottled, firm silty clay loam and loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, mottled loam. In places the surface layer is darker. In some areas the subsoil contains more clay. In a few small areas the soil has more than 40 inches of silty material.

Typically, the surface layer of the Crosby soil is dark brown silt loam about 9 inches thick. The subsoil is about 29 inches thick. It is grayish brown and brown, mottled, firm silty clay loam in the upper part; light olive brown, mottled, firm clay loam in the next part; and yellowish brown, mottled, firm loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, mottled loam. In places the upper part of the subsoil contains more sand. In some areas the surface layer is darker.

Included with these soils in mapping are the very poorly drained Mahalasville and Treaty soils in depressions and drainageways and the well drained Miami soils and some moderately well drained soils on slight rises and in the more sloping areas along drainageways. Also included are areas of the somewhat poorly drained Starks soils in landscape positions similar to those of the Fincastle soil. Starks soils are underlain by stratified material. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Fincastle and Crosby soils. Permeability is moderate in the upper part of the solum in the Fincastle soil, moderately slow in the lower part of the solum, and slow in the underlying material. It is slow in the Crosby soil. Surface runoff is medium on both soils. The content of organic matter in the surface layer is moderately low. Both soils have a high water table at a depth of 1 to 3 feet in winter and early spring.

Most areas are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

These soils are well suited to corn, soybeans, and small grain. Wetness and erosion are the major management concerns. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to no-till and ridge-till tillage systems. They are also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay

and pasture. The wetness and the hazard of erosion are concerns. Subsurface drains can be used to remove excess water if adequate outlets are available. Growing grasses and legumes helps to control runoff and erosion. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soils are too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness is a severe limitation if these soils are used as sites for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soils are severely limited as sites for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soils to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

Hd—Harpster silt loam, pothole. This nearly level, very deep, very poorly drained soil is in depressions on outwash plains. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is black silt loam about 11 inches thick. The subsoil is about 19 inches thick. It is dark gray, friable silt loam in the upper part and dark grayish brown, firm silty clay loam in the lower part. The underlying material to a depth of 60 inches or more is gray silt loam. In a few places the surface layer is mucky.

Included with this soil in mapping are small areas of the very poorly drained Pella soils and Mahalasville soils that have a gravelly substratum. These soils are in the slightly higher positions at the edges of deep depressions. They are not calcareous in the upper part of the subsoil. They make up about 10 percent of the unit.

The available water capacity is very high in the Harpster soil. Permeability is moderate. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface, mainly during the winter and spring. The surface layer is calcareous and has a high pH. These conditions may affect the uptake of plant nutrients.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is poorly suited to corn and soybeans. Wetness and the ponding are the major management concerns. Crusting is also a concern. Small grain planted in the fall is subject to severe damage during periods of prolonged ponding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to fall moldboard, fall chisel, and ridge-till tillage systems. It is also well suited to no-till if the new crop is planted into soybean residue.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for pasture. It is fairly well suited to hay. The wetness and the ponding are concerns. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the ponding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, ponding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IVw. No woodland ordination symbol is assigned.

HfB2—High Gap Variant silt loam, 1 to 6 percent slopes, eroded. This nearly level and gently sloping, moderately well drained soil is in undulating areas and along drainageways on uplands. It is moderately deep

over interbedded siltstone and shale bedrock. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is about 27 inches thick. It is dark yellowish brown, firm silt loam in the upper part; dark brown, firm clay loam in the next part; and dark yellowish brown, mottled, firm channery clay loam in the lower part. Below this to a depth of 60 inches or more is interbedded siltstone and shale bedrock. In some places the surface layer is darker. In a few areas the underlying bedrock is at a depth of more than 40 inches or less than 20 inches. In the northeastern part of the county, the bedrock is New Albany shale.

Included with this soil in mapping are small areas of the somewhat poorly drained Shadeland soils in the more level areas and in drainageways. Also included, in depressions and drainageways, are a few areas of the very poorly drained Mahalasville soils that have a shale substratum. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the High Gap Variant soil. Permeability is moderate in the upper part of the solum and moderately slow in the lower part. Surface runoff is medium. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 2.0 to 3.5 feet, mainly in winter and spring.

Most areas of this soil are used for cultivated crops, hay, or pasture. Many areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to fall moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Wetness and the shrink-swell potential are moderate limitations if this soil is used as a site for dwellings without basements. Because of the wetness, the soil is severely limited as a site for dwellings with basements. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Foundations and footings should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

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

HfC2—High Gap Variant silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, moderately well drained soil is in undulating areas and along drainageways on uplands. It is moderately deep over interbedded siltstone and shale bedrock. Individual areas are long and narrow or irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is about 26 inches thick. It is dark yellowish brown, firm silty clay loam in the upper part; dark brown, firm clay loam in the next part; and dark yellowish brown, mottled, firm channery clay loam in the lower part. Below this to a depth of 60 inches or more is interbedded siltstone and shale bedrock. In some areas the underlying bedrock is at a depth of more than 40 inches or less than 20 inches. In a few areas the surface layer is darker. In the northeastern part of the county, the bedrock is New Albany shale.

Included with this soil in mapping are areas of the somewhat poorly drained Shadeland soils on toe slopes and in drainageways; areas of the well drained Berks soils and bedrock escarpments where the slope is more than 12 percent, adjacent to drainageways and narrow flood plains; and small severely eroded areas where the surface soil is silty clay loam or clay loam. Included areas make up about 15 percent of the unit.

The available water capacity is low in the High Gap Variant soil. Permeability is moderate in the upper part of the solum and moderately slow in the lower part. Surface runoff is medium. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 2.0 to 3.5 feet, mainly in winter and spring.

Most areas of this soil are used for cultivated crops, hay, or pasture. Many areas are used as woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring chisel if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Wetness, the shrink-swell potential, and the slope are moderate limitations if this soil is used as a site for dwellings without basements. The wetness is a severe limitation on sites for dwellings with basements. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Foundations and footings should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. The buildings should be designed so that they conform to the natural slope of the land. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads with a more suitable material improves the ability of the soil to support vehicular traffic.

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

HnB—Hononegah loamy sand, 2 to 6 percent slopes. This gently sloping, excessively drained soil is on rises and breaks on stream terraces. It is moderately deep or deep over very gravelly coarse sand. Individual areas are elongated or irregularly shaped and range from 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 10 inches thick. The subsoil is about 24 inches thick. It is dark brown, very friable loamy sand and gravelly loamy sand. The underlying material to a depth of 60 inches or more is yellowish brown very gravelly coarse sand. In places the upper part of the subsoil contains more gravel. In some areas the underlying very gravelly coarse sand is at a depth of less than 30 inches. In a few places the surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of the excessively drained Rodman and well drained Strawn soils on the steeper breaks. Rodman soils have a solum that is less than 15 inches thick. Also included, on toe slopes, are the somewhat poorly drained Sleeth soils and the very poorly drained Mahalasville soils that have a gravelly substratum. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Hononegah soil. Permeability is rapid in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Water erosion and soil blowing are hazards, and droughtiness is a limitation. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion and soil blowing, reduce the evaporation rate, and maintain or improve tilth,

infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring chisel if the new crop is planted into corn residue.

This soil is fairly well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay. It is well suited to pasture. Water erosion and soil blowing are hazards, and droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control runoff, soil blowing, and water erosion. Overgrazing reduces plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer help to keep the pasture in good condition.

This soil is suitable for use as a site for dwellings and local roads and streets.

The land capability classification is IVs. No woodland ordination symbol is assigned.

HoA—Hononegah fine sandy loam, 0 to 2 percent slopes. This nearly level, excessively drained soil is on stream terraces. It is moderately deep or deep over very gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 11 inches thick. The subsoil is about 34 inches thick. It is dark yellowish brown and dark brown, very friable fine sandy loam and loamy sand in the upper part and dark brown, very friable gravelly loamy sand and gravelly sand in the lower part. The underlying material to a depth of 60 inches or more is brown very gravelly coarse sand. In places the dark surface layer is less than 10 inches thick or is lighter colored. In a few small areas the surface layer and the upper part of the subsoil contain more gravel. In some places the underlying gravelly material is at a depth of more than 50 inches or less than 30 inches.

Included with this soil in mapping are the excessively drained Rodman and well drained Strawn soils on the steeper terrace breaks. Rodman soils have a solum that is less than 15 inches thick. Also included, in the lower lying areas and in depressions, are the somewhat poorly drained Sleeth soils and the very poorly drained Mahalasville soils that have a gravelly substratum. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Hononegah soil. Permeability is rapid in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Droughtiness is a limitation, and soil blowing is a hazard. Irrigation helps to overcome the droughtiness. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring chisel if the new crop is planted into corn residue.

This soil is fairly well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay. It is well suited to pasture. Droughtiness is a limitation, and soil blowing is a hazard. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control soil blowing. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is suitable for use as a site for dwellings and local roads and streets.

The land capability classification is IVs. No woodland ordination symbol is assigned.

Hv—Houghton muck, undrained. This nearly level, very deep, very poorly drained soil is in depressions on outwash plains, terraces, recessional moraines, and till plains. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 90 acres in size.

Typically, the surface layer is black muck about 6 inches thick. Below this to a depth of 60 inches or more is friable muck. It is black in the upper part and dark reddish brown in the lower part. In some places the soil has layers of fibers that are not as well decomposed. In other places overwash mineral material has been mixed with the surface layer. In a few small areas either mineral material or coprogenous earth is within a depth of 50 inches.

Included with this soil in mapping are the very poorly drained Mahalasville, Treaty, and Pella soils and the poorly drained Drummer soils in the slightly higher positions at the edges of deep depressions. These soils

formed in mineral material. They make up about 15 percent of the unit.

The available water capacity is very high in the Houghton soil. Permeability ranges from moderately slow to moderately rapid. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is very high. The water table is at or above the surface during the winter and spring.

Most areas of this soil have not been drained. They are idle land or are used as wildlife habitat. A few areas are used for pasture.

This soil is generally unsuited to cultivated crops and hay and is poorly suited to pasture. Wetness and the ponding are the major limitations.

This soil is poorly suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding and subsidence, this soil is generally unsuited to use as a site for dwellings. Because of the subsidence, the ponding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Replacing the organic material with a more suitable base material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is Vw. The woodland ordination symbol is 2W.

KaA—Kalamazoo loam, 0 to 2 percent slopes. This nearly level, well drained soil is on outwash plains and stream terraces. It is deep or very deep over coarse sand and very gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 700 acres in size.

Typically, the surface layer is brown loam about 11 inches thick. The subsoil is about 50 inches thick. It is brown, firm loam in the upper part; brown, firm sandy clay loam in the next part; and dark brown, friable loamy coarse sand in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown, stratified very gravelly coarse sand and coarse sand. In some places the surface layer is darker. In a few areas the lower part of the subsoil has more clay.

Included with this soil in mapping are the moderately well drained Thackery soils in drainageways and at the lower elevations. Also included are small areas of the excessively drained Rodman and well drained Kosciusko soils in the steeper areas along terrace breaks and drainageways. Kosciusko soils have a solum that is less than 40 inches thick. Included soils make up about 10 percent of the unit.

The available water capacity is moderate in the Kalamazoo soil. Permeability is moderate in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Droughtiness is a limitation. Crusting is also a concern. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops minimize crusting and evaporation and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

This soil is suitable for use as a site for dwellings and local roads and streets.

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

KaB2—Kalamazoo loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on breaks and along drainageways on outwash plains and stream terraces. It is deep or very deep over coarse

sand and gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is dark brown loam about 10 inches thick. It contains dark brown material from the subsoil. The subsoil is about 51 inches thick. It is dark brown, firm clay loam and gravelly sandy clay loam in the upper part; dark brown, friable gravelly sandy loam and loamy sand in the next part; and dark brown, very friable gravelly loamy sand and loamy sand in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown, stratified coarse sand and gravelly coarse sand. In a few areas the lower part of the subsoil has more clay. In places the surface layer is darker.

Included with this soil in mapping are the moderately well drained Thackery soils in drainageways and on toe slopes and small areas of the excessively drained Rodman and well drained Kosciusko soils in the steeper areas along terrace breaks and drainageways. Kosciusko soils have a solum that is less than 40 inches thick. Also included are small severely eroded areas that have a surface soil of clay loam or that have gravelly textures. Included soils make up about 10 percent of the unit.

The available water capacity is moderate in the Kalamazoo soil. Permeability is moderate in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard, and droughtiness is a limitation. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, minimize crusting and evaporation, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

This soil is suitable for use as a site for dwellings and for local roads and streets.

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

KbB2—Kalamazoo silt loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on breaks and along drainageways on outwash plains and stream terraces. It is deep or very deep over very gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 60 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil is about 37 inches thick. It is dark yellowish brown, firm silty clay loam and clay loam in the upper part; brown, firm clay loam and sandy clay loam in the next part; and dark brown, friable gravelly loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown very gravelly coarse sand. In some places the surface layer is darker. In a few small areas the lower part of the subsoil has more clay.

Included with this soil in mapping are small areas of the moderately well drained Thackery soils on toe slopes. Also included are the well drained Kosciusko and excessively drained Rodman soils in the steeper areas along terrace breaks and drainageways. Kosciusko soils have a solum that is less than 40 inches thick. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Kalamazoo soil. Permeability is moderate in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard, and droughtiness is a limitation. Crusting is also a concern. Erosion and runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization

structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, minimize crusting and evaporation, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

This soil is suitable for use as a site for dwellings and local roads and streets.

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

KcB2—Kalamazoo silt loam, kame, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on kames. It is deep or very deep over sand and gravelly sand. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. It contains dark brown material from the subsoil. The subsoil is about 44 inches thick. It is dark brown, firm clay loam and sandy clay loam in the upper part and strong brown, friable loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, stratified sand and gravelly sand. In some places glacial till is at a depth of less than 60 inches. In a few areas the lower part of the subsoil has more clay. In places the surface layer is darker. In many areas the underlying material has thin strata ranging from silt loam to sandy loam.

Included with this soil in mapping are the well drained Kosciusko soils in the more sloping areas and at the summit of narrow ridges. These soils have a solum that is less than 40 inches thick. Also included are small severely eroded areas that have a surface soil of silty clay loam or clay loam or that have gravelly textures. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Kalamazoo soil. Permeability is moderate in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

This soil is suitable for use as a site for dwellings and local roads and streets.

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

KcC2—Kalamazoo silt loam, kame, 6 to 12 percent slopes, eroded. This moderately sloping, well drained soil is on kames. It is deep or very deep over sand and gravelly sand. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is brown silt loam about 8

inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is about 37 inches thick. It is dark yellowish brown, firm silty clay loam in the upper part; dark brown, firm clay loam in the next part; and dark brown, very friable gravelly loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, stratified sand and gravelly sand. In some places glacial till is at a depth of less than 60 inches. In a few areas the lower part of the subsoil has more clay. In places the surface layer is darker. In many areas the underlying material has thin strata ranging from silt loam to sandy loam.

Included with this soil in mapping are the well drained Kosciusko soils near the summit of narrow ridges and in the more sloping areas. These soils have a solum that is less than 40 inches thick. Also included are small severely eroded areas that have a surface soil of silty clay loam or clay loam or that are gravelly. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Kalamazoo soil. Permeability is moderate in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for hay or pasture. Some areas are used for cultivated crops or as woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring chisel if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The slope is a moderate limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. The slope is also a moderate limitation on sites for local roads and streets. Where possible, constructing the roads on the contour reduces the amount of land grading needed to overcome the slope. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

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

KoD2—Kosciusko sandy loam, 12 to 18 percent slopes, eroded. This strongly sloping, well drained soil is on eskers, terraces, outwash plains, and kames. It is moderately deep over sand and very gravelly sand. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is very dark gray sandy loam about 5 inches thick. The subsoil is 22 inches thick. It is dark brown, firm gravelly sandy clay loam in the upper part and dark brown, friable very gravelly sandy loam in the lower part. The underlying material to a depth of 60 inches or more is brown, stratified sand and very gravelly sand. In places sand and very gravelly sand are at a depth of less than 24 inches or more than 40 inches. In a few areas the upper part of the subsoil contains less gravel. In many places the soil contains thin strata ranging from silt loam to sandy loam. In some areas the surface layer is dark and is thicker.

Included with this soil in mapping are the well drained Kalamazoo soils in the more level areas and on toe slopes. These soils have a solum that is more than 40 inches thick. Also included are soils that have a gravelly or cobbly surface layer. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Kosciusko soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is rapid. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for woodland, hay, or pasture. A few areas are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grain. Water erosion and soil blowing are the major hazards, and droughtiness is the major limitation. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control

basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion and soil blowing, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for pasture. It is fairly well suited to hay. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are seedling mortality and plant competition. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The slope is a severe limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. The slope is also a severe limitation on sites for local roads and streets. Cuts and fills are needed. Where possible, constructing the roads on the contour helps to overcome the slope.

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

KpC3—Kosciusko gravelly sandy clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, well drained soil is on terrace breaks and along drainageways on terraces and outwash plains. It is moderately deep over sand and very gravelly sand. In most areas, the original dark surface layer has been removed by erosion and tillage has mixed the rest with the upper part of the subsoil. Individual areas of this soil are long and narrow or irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is brown gravelly sandy clay loam about 8 inches thick. The subsoil is 19 inches thick. It is dark brown, firm gravelly sandy clay loam in the upper part and dark brown, firm gravelly sandy loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, stratified sand and very gravelly sand. In places sand and very gravelly sand are at a depth of less than 24 inches or more than 40 inches. In a few areas the surface layer and the upper part of the subsoil have less gravel. In some places the surface layer is darker.

Included with this soil in mapping are the well drained Kalamazoo soils in the more level areas. These soils have a solum that is more than 40 inches thick. Also included are areas of soils that have a cobbly surface layer. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Kosciusko soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low. The gravelly surface layer makes tillage difficult. Also, the surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion and droughtiness are the major management concerns. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring chisel if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for pasture. It is fairly well suited to hay. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce

plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The slope is a moderate limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Because of the slope and the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage. Where possible, constructing the roads on the contour reduces the amount of land grading needed to overcome the slope.

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

LaA—Lafayette silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on outwash plains. It is deep or very deep over gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 200 acres in size.

Typically, the surface layer is very dark gray silt loam about 10 inches thick. The subsurface layer is very dark gray, friable silt loam about 3 inches thick. The subsoil is about 52 inches thick. It is brown, dark yellowish brown, and yellowish brown, mottled, firm silt loam and silty clay loam in the upper part; grayish brown and dark grayish brown, mottled, friable sandy loam and loamy coarse sand in the next part; and dark grayish brown, mottled, firm gravelly sandy loam in the lower part. The underlying material to a depth of 70 inches or more is brown gravelly coarse sand. In some places the dark surface layer is less than 10 inches thick. In a few small areas the silty material is less than 24 inches or more than 40 inches thick.

Included with this soil in mapping are the moderately well drained and well drained Waupecan soils, the moderately well drained Bowes Variant soils, and the well drained Bowes soils in the slightly higher areas. Also included, in depressions, are the very poorly drained Mahalasville soils that have a gravelly substratum. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Lafayette soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1 to 3 feet in winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The wetness is a severe limitation if this soil is used as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIw. No woodland ordination symbol is assigned.

LeA—La Hogue loam, till substratum, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on till plains. It is deep over compact glacial till. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is very dark gray loam about 10 inches thick. The subsoil is about 37 inches thick. It is dark brown, mottled, friable loam in the upper part; dark brown and dark grayish brown, mottled, firm clay loam in the next part; and brown, mottled, friable sandy loam and loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown loam. In places the dark surface layer

is less than 10 inches thick. In a few small areas the surface layer is silt loam. In some places the subsoil contains less clay and more sand.

Included with this soil in mapping are small areas of the somewhat excessively drained Oakville and well drained Linkville soils and the moderately well drained Billett soils that are moderately wet. These soils are in the slightly higher areas. Also included are the poorly drained Drummer soils in the lower lying areas in depressions. Included soils make up about 5 percent of the unit.

The available water capacity is high in the La Hogue soil. Permeability is moderate in the solum and slow in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1 to 3 feet in winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve soil tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The wetness is a severe limitation if this soil is used as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of the potential for frost action, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIw. No woodland ordination symbol is assigned.

Lm—Lash silt loam, frequently flooded. This nearly level, very deep, well drained soil is on flood plains. It is subject to frequent flooding for brief or long periods during the winter and spring. Individual areas are irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 38 inches thick. It is dark brown, friable silt loam in the upper part and dark brown, friable loam in the lower part. The underlying material to a depth of 60 inches or more is dark brown loamy sand. In places the surface layer is 24 or more inches thick.

Included with this soil in mapping are the well drained Battleground soils in areas farther away from stream channels adjacent to uplands. These soils have more clay and less sand in the subsoil than the Lash soil. Also included, in areas adjacent to stream channels, are the somewhat excessively drained Ouiatenon soils that have a sandy substratum. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Lash soil. Permeability is moderately rapid in the solum and rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is well suited to corn and soybeans, but damage from floodwaters can be expected. Flooding is the major hazard. Crusting is also a concern. Small grain planted in the fall is subject to severe damage during periods of prolonged flooding. Late spring planting of adapted crops helps to minimize the damage or loss caused by flooding. Levees and dikes help to control flooding, but they are extremely expensive if properly constructed. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, spring chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops in winter and spring. Levees and dikes help to control flooding. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during periods when the soil is wet

help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation and plant competition. The frequent flooding can delay planting and harvesting. The equipment limitation can be reduced by delaying timber harvest until dry periods. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding, this soil is generally unsuited to use as a site for dwellings and is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent flood damage.

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

LnA—Lauramie silt loam, 0 to 2 percent slopes. This nearly level, very deep, well drained soil is on till plains and recessional moraines. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is about 55 inches thick. It is dark yellowish brown, friable silt loam and dark brown, firm silty clay loam in the upper part; brown, firm clay loam, loam, and sandy clay loam in the next part; and yellowish brown, firm fine sandy loam in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown fine sandy loam. In some areas unweathered glacial till is at a depth of less than 40 inches. In places the upper part of the subsoil has more sand. In a few areas stratified sandy and gravelly material is in the subsoil. In some places the surface layer is lighter colored. In other places the surface layer is dark and is more than 10 inches thick.

Included with this soil in mapping are the well drained Mellott, Octagon, and Tecumseh soils. Mellott and Tecumseh soils have less sand in the upper part of the subsoil than the Lauramie soil. They are in the less sloping areas at the higher elevations. Octagon soils have a solum that is less than 40 inches thick. They are in the more sloping areas. Also included are small areas of moderately well drained soils in drainageways. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Lauramie soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

The land capability classification is I. No woodland ordination symbol is assigned.

LnB2—Lauramie silt loam, 2 to 6 percent slopes, eroded. This gently sloping, very deep, well drained soil is on rises and along drainageways on till plains and recessional moraines. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. It contains dark brown material from the subsoil. The subsoil is 41 inches thick. It is dark brown, firm silty clay loam and clay loam in the upper part and dark yellowish brown, firm fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown fine sandy loam. In some areas unweathered glacial till is at a depth of less than 40 inches. In places the surface layer and the upper part of the subsoil have more sand. In a few areas the lower part of the subsoil has stratified sandy and gravelly material. In some places the surface layer is lighter colored. In other places the dark surface layer is more than 10 inches thick.

Included with this soil in mapping are areas of the well drained Mellott, Octagon, and Tecumseh soils. Octagon soils have a solum that is less than 40 inches thick. They are in the more sloping areas. Mellott and Tecumseh soils have less sand in the upper part of the subsoil than the Lauramie soil. They are in the more level areas at the slightly higher elevations. Also

included are small severely eroded areas that have a surface soil of silty clay loam or clay loam. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Lauramie soil. Permeability is moderate. Surface runoff is medium. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a severe limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

The land capability classification is IIe. No woodland ordination symbol is assigned.

LoA—Linkville loam, loamy substratum, 0 to 2 percent slopes. This nearly level, very deep, well drained soil is on till plains and recessional moraines. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is very dark gray loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable loam about 5 inches thick. The subsoil is about 55 inches thick. It is dark brown, friable loam and brown, firm clay loam in the upper part; dark yellowish brown, firm clay loam in the next part; and dark yellowish brown and brown, friable loam in the lower part. The underlying material to a depth of 80 inches or more is brown loam. In places, the surface layer is sandy loam and the upper part of the subsoil has less clay. In a few areas the subsoil has stratified sandy and gravelly material. In some places the dark surface layer is less than 10 inches thick.

Included with this soil in mapping are a few small areas of the well drained Spinks soils on rises. These soils have a lighter colored surface layer than the Linkville soil and have less clay in the subsoil. Also included are small areas that have slopes of more than 2 percent. Included areas make up about 10 percent of the unit.

The available water capacity is high in the Linkville soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suitable for use as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is I. No woodland ordination symbol is assigned.

LoB—Linkville loam, loamy substratum, 2 to 6 percent slopes. This gently sloping, very deep, well drained soil is on rises and along drainageways on till

plains and recessional moraines. Individual areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is 48 inches thick. It is dark brown, friable loam and firm clay loam in the upper part and dark yellowish brown and yellowish brown, friable loam in the lower part. The underlying material to a depth of 70 inches or more is brown loam. In some areas unweathered glacial till is at a depth of less than 40 inches. In places, the surface layer is sandy loam and the upper part of the subsoil contains less clay. In a few areas the dark surface layer is less than 10 inches thick.

Included with this soil in mapping are a few small areas of the well drained Spinks soils on rises and in the more sloping areas. These soils have a lighter colored surface layer than the Linkville soil and have less clay in the subsoil. They make up about 10 percent of the unit.

The available water capacity is high in the Linkville soil. Permeability is moderate. Surface runoff is medium. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suitable for use as a site for dwellings. Because of the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIe. No woodland ordination symbol is assigned.

LvB2—Longlois silt loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on rises and along drainageways on outwash plains. It is deep over gravelly loamy coarse sand and sand. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. It contains dark brown material from the subsoil. The subsoil is 45 inches thick. It is dark brown, firm silty clay loam, clay loam, and sandy clay loam in the upper part and dark brown, firm gravelly and very gravelly sandy clay loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown gravelly loamy coarse sand that has strata of sand. In places glacial till is at a depth of less than 60 inches. In a few areas the lower part of the subsoil has less clay. In some places the surface layer is lighter colored.

Included with this soil in mapping are the well drained Bowes and Waupecan soils in the more level areas on the upper part of side slopes and on toe slopes. These soils have less sand in the upper part of the subsoil than the Longlois soil. Also included are severely eroded areas that have a surface soil of silty clay loam or clay loam and areas of the well drained Desker soils on knobs and in the more sloping areas. Desker soils have less clay in the subsoil than the Longlois soil. Also, they have a solum that is less than 40 inches thick. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Longlois soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, conservation tillage, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective

cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

The land capability classification is IIe. No woodland ordination symbol is assigned.

LwB2—Longlois silt loam, kame, 2 to 6 percent slopes, eroded. This sloping, well drained soil is on kames and eskers. It is deep over gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 120 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is 50 inches thick. It is dark yellowish brown, firm silty clay loam and clay loam in the upper part and dark brown, firm gravelly sandy clay loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown gravelly coarse sand. In places glacial till is at a depth of less than 60 inches. In a few areas the lower part of the subsoil has less clay. In some areas the surface layer is lighter colored. In a few places the underlying material has thin strata ranging from silt loam to sandy loam.

Included with this soil in mapping are areas of the well drained Bowes, Desker, and Waupecan soils. Bowes and Waupecan soils have less sand in the upper part of the subsoil than the Longlois soil. They are in the more level areas. Desker soils are in the more sloping areas. They have less clay in the subsoil than the Longlois soil and have a solum that is less than 40 inches thick. Also included are small severely eroded areas that have a surface soil of silty clay loam or clay loam. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Longlois soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderate.

Most areas of this unit are used for cultivated crops. Some areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

The land capability classification is IIe. No woodland ordination symbol is assigned.

Mb—Mahalasville silty clay loam, gravelly substratum. This nearly level, very poorly drained soil is in depressions on terraces and outwash plains. It is deep over very gravelly loamy sand and gravelly sand. It is frequently ponded by surface runoff from adjacent

areas. Individual areas are irregular in shape and range from 2 to 120 acres in size.

Typically, the surface layer is black silty clay loam about 9 inches thick. The subsurface layer also is black silty clay loam. It is about 4 inches thick. The subsoil is about 33 inches thick. The upper part is very dark gray and dark gray, mottled, firm silty clay loam, and the lower part is grayish brown and dark olive gray, mottled, firm clay loam and sandy clay loam. The underlying material to a depth of 60 inches or more is dark grayish brown very gravelly loamy sand and gravelly sand. In some areas the silty material is more than 40 inches thick. In places, the underlying gravelly material is thin and glacial till is within a depth of 60 inches. In some areas, the upper part of the subsoil has more sand and less clay and the underlying gravelly material is within a depth of 40 inches.

Included with this soil in mapping are the moderately well drained Waupecan and somewhat poorly drained Lafayette soils. These soils are in the slightly higher positions on the landscape. They make up about 10 percent of the unit.

The available water capacity is high in the Mahalasville soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface, mainly during the winter and spring. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness and the ponding are major management concerns. Crusting is also a concern. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to fall moldboard, fall chisel, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation, and ponding is a hazard. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The major management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, the ponding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Mc—Mahalasville silty clay loam, shale substratum. This nearly level, very poorly drained soil is in depressions and drainageways on bedrock terraces. It is deep over shale bedrock. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 3 to 20 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsoil is about 49 inches thick. It is dark gray and grayish brown, mottled, firm silty clay loam in the upper part; dark grayish brown and very dark grayish brown, mottled, firm clay loam and loam in the next part; and dark gray loamy coarse sand in the lower part. Weathered shale bedrock is at a depth of about 59 inches. In the west-central part of the county, the bedrock is interbedded siltstone and shale of Mississippian age. In some areas the underlying material is gravelly. In places the underlying shale is at a depth of less than 40 inches or more than 60 inches. In a few areas the upper part of the subsoil has more clay or more sand.

Included with this soil in mapping are small areas of the moderately well drained High Gap Variant and somewhat poorly drained Shadeland soils in the slightly higher positions on the landscape. Included soils make up about 10 percent of the unit.

The available water capacity is high in the Mahalasville soil. Permeability is moderate in the upper part of the solum and moderately rapid in the lower part. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface during the winter and spring. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness and the ponding are the major management concerns. Crusting is also a concern. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to fall moldboard, fall chisel, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation, and ponding is a hazard. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, the potential for frost action, and the ponding, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Md—Mahalasville-Treaty complex. This map unit consists of nearly level, very poorly drained soils in depressions and drainageways on till plains and recessional moraines. It is frequently ponded by surface runoff from adjacent areas. The Mahalasville soil is very deep over compact glacial till, and the Treaty soil is deep over compact glacial till. Individual areas of this unit are irregular in shape and generally range from 2 to 100 acres in size, but some broad areas are more than 1,000 acres in size. The areas of this unit are about 50 percent Mahalasville soil and 35 percent Treaty soil. The two soils occur as areas so intricately mixed that it was not practical to map them separately.

Typically, the surface layer of the Mahalasville soil is black silty clay loam about 12 inches thick. The subsoil is about 36 inches thick. The upper part is dark gray and grayish brown, mottled, firm silty clay loam. The lower part is grayish brown, mottled, firm loam that has strata of silt loam. The underlying material to a depth of 60 inches or more is light olive brown loamy sand that has strata of fine sandy loam. In places the underlying material is gravelly. In a few small areas the soil has more than 40 inches of silty material. In some places glacial till is within a depth of 60 inches.

Typically, the surface layer of the Treaty soil is very dark grayish brown silty clay loam about 10 inches thick. The subsoil is about 38 inches thick. It is dark gray and grayish brown, mottled, firm silty clay loam in the upper part and grayish brown, mottled, firm silt loam and loam in the lower part. The underlying material to a depth of 60 inches or more is light olive brown, mottled loam. In a few small areas, stratified material is above the underlying glacial till. In places the underlying compact glacial till is within a depth of 40 inches. In some areas the soil has more than 40 inches of silty material.

Included with these soils in mapping are small areas of the somewhat poorly drained Crosby, Fincastle, and

Starks soils in the slightly higher positions on the landscape. Included soils make up about 10 percent of the unit.

The available water capacity is very high in the Mahalasville soil and high in the Treaty soil. Permeability is moderate in the Mahalasville soil. It is moderate in the solum of the Treaty soil and moderately slow in the underlying material. Surface runoff is very slow or ponded on both soils. The content of organic matter in the surface layer is high. The water table is at or above the surface, mainly during the winter and spring. The surface layer of both soils becomes cloddy and hard to work if tilled when too wet.

Most areas are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

These soils are well suited to corn, soybeans, and small grain. Wetness and the ponding are the major management concerns. Crusting is also a concern. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to fall moldboard, fall chisel, and ridge-till tillage systems.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation, and ponding is a hazard. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soils are relatively dry or are frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding, these soils are generally unsuited to use as sites for dwellings. Because of low strength, the ponding, and the potential for frost action, the soils are severely limited as sites for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

MmB2—Marker silt loam, 2 to 6 percent slopes, eroded. This gently sloping, moderately well drained soil is on recessional moraines. It is moderately deep over compact glacial till. Individual areas are irregular in shape and range from 2 to 350 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. It contains olive brown material from the subsoil. The subsoil is about 18 inches thick. The upper part is olive brown, firm clay loam; the next part is light olive brown, mottled, firm clay loam; and the lower part is light olive brown, mottled, firm silt loam. The underlying material to a depth of 60 inches or more is olive silt loam. In some places the dark surface layer is 10 or more inches thick. In a few areas stratified material is above the glacial till. In some places the upper part of the subsoil has more clay. In other places the surface layer is lighter colored.

Included with this soil in mapping are the somewhat poorly drained Beecher soils in the more level areas. Also included are a few areas of the poorly drained Drummer soils in depressions and drainageways. Included soils make up about 10 percent of the unit.

The available water capacity is moderate in the Marker soil. Permeability is moderate in the solum and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1.5 to 3.0 feet in winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of

conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing and grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The wetness is a moderate limitation if this soil is used as a site for dwellings without basements. It is a severe limitation on sites for dwellings with basements. Constructing buildings on raised, well compacted fill material helps to overcome the wetness. Installing subsurface drains helps to lower the water table. Because of the potential for frost action, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIe. No woodland ordination symbol is assigned.

MoA—Mellott silt loam, 0 to 2 percent slopes. This nearly level, very deep, well drained soil is on till plains. Individual areas are irregular in shape and range from 2 to 150 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 41 inches thick. It is dark brown, friable silt loam and dark yellowish brown, firm silty clay loam in the upper part; dark brown, firm loam and sandy clay loam in the next part; and yellowish brown, firm fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown loam. In places the dark surface layer is 10 or more inches thick. In a few areas the surface layer is lighter colored. In some places the depth to glacial till is more than 60 inches.

Included with this soil in mapping are the moderately well drained Throckmorton soils and the somewhat poorly drained Toronto and Millbrook soils in the slightly lower positions on the landscape. These soils make up about 12 percent of the unit.

The available water capacity is high in the Mellott soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is I. No woodland ordination symbol is assigned.

MsC2—Miami silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, well drained soil is in undulating areas and along drainageways on till plains and recessional moraines. It is moderately deep over compact glacial till. Individual areas are long and narrow or irregularly shaped and range from 2 to 150 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is 26 inches thick. It is dark yellowish brown, firm silty clay loam in the upper part and dark yellowish brown and yellowish brown, firm clay loam and loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown loam. In places the underlying compact glacial till is at a depth of less than 24 inches. In a few areas the surface layer is darker.

Included with this soil in mapping are areas of the

somewhat poorly drained Crosby and Fincastle soils on toe slopes and in drainageways and the well drained Richardville soils in landscape positions similar to those of the Miami soil. Richardville soils have a solum that is more than 40 inches thick. Also included are small severely eroded areas that have a surface soil of silty clay loam or clay loam. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Miami soil. Permeability is moderate in the upper part of the subsoil, moderately slow in the lower part of the subsoil, and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring chisel if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The shrink-swell potential and the slope are moderate limitations if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. The buildings should be designed so that they conform to the natural slope of the land. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

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

MsD2—Miami silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, well drained soil is in undulating areas and along drainageways on till plains and recessional moraines. It is moderately deep over compact glacial till. Individual areas are long and narrow or irregularly shaped and range from 2 to 80 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is firm clay loam about 24 inches thick. It is dark yellowish brown in the upper part and brown in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown loam. In places the underlying compact glacial till is at a depth of less than 24 inches. In a few areas the surface layer is darker.

Included with this soil in mapping are areas that have slopes of more than 18 percent on short breaks along drainageways and streams and areas of the well drained Richardville soils on the upper part of side slopes. Richardville soils have a solum that is more than 40 inches thick. Also included are small severely eroded areas that have a surface soil of silty clay loam or clay loam. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Miami soil. Permeability is moderate in the upper part of the subsoil, moderately slow in the lower part of the subsoil, and slow in the underlying material. Surface runoff is rapid. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for hay or pasture. A few areas are used for cultivated crops or as woodland or are idle land.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter.

This soil is fairly well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay. It is well suited to pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The slope is a severe limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Because of the slope and low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Cuts and fills are needed. Where possible, building the roads on the contour helps to overcome the slope.

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

MtC3—Miami clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, well drained soil is in undulating areas and along drainageways on till plains and recessional moraines. It is moderately deep over compact glacial till. In most areas, the original dark surface layer has been removed by erosion and tillage has mixed the rest with the upper part of the subsoil. Individual areas of this soil are long and narrow or irregularly shaped and range from 2 to 40 acres in size.

Typically, the surface layer is brown clay loam about 7 inches thick. The subsoil is 22 inches thick. It is dark yellowish brown, firm clay loam in the upper part and yellowish brown, firm loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown loam. In some places the underlying compact glacial till is at a depth of less than 24 inches. In a few areas the surface layer is darker.

Included with this soil in mapping are the somewhat poorly drained Fincastle and Crosby soils on toe slopes and in drainageways and areas of the well drained Richardville soils in landscape positions similar to those of the Miami soil. Richardville soils have a solum that is more than 40 inches thick. Also included are soils that have a cobbly surface layer. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Miami soil. Permeability is moderate in the upper part of the subsoil, moderately slow in the lower part of the subsoil, and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is low. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring chisel if the new crop is planted into corn residue.

This soil is fairly well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay. It is well suited to pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The shrink-swell potential and the slope are moderate limitations if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. The buildings should be designed so that they conform to the natural slope of the land. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

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

MtD3—Miami clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, well drained soil is in undulating areas and along drainageways on till plains and recessional moraines. It is moderately deep over compact glacial till. In most areas, the original dark surface layer has been removed by erosion and tillage has mixed the rest with the upper part of the subsoil. Individual areas of this soil are long and narrow or irregularly shaped and range from 2 to 10 acres in size.

Typically, the surface layer is dark yellowish brown clay loam about 5 inches thick. The subsoil is 24 inches thick. It is dark yellowish brown, firm clay loam in the upper part and yellowish brown, firm clay loam and loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown loam. In places the underlying compact glacial till is at a depth of less than 24 inches. In a few areas the surface layer is darker.

Included with this soil in mapping are areas that have slopes of more than 18 percent on short breaks along drainageways and streams and areas of the well drained Richardville soils on the upper part of side slopes. Richardville soils have a solum that is more than 40 inches thick. Also included are soils that have a cobbly surface layer. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Miami soil. Permeability is moderate in the upper part of the subsoil, moderately slow in the lower part of the subsoil, and slow in the underlying material. Surface runoff is rapid. The content of organic matter in the surface layer is low. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for hay or pasture. A few areas are used for cultivated crops or as woodland.

Because of the severe hazard of erosion, this soil is generally unsuited to corn, soybeans, and small grain.

This soil is poorly suited to grasses and legumes, such as orchardgrass and alfalfa, for hay. It is fairly well suited to pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The slope is a severe limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Because of the slope and low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Cuts and fills are needed. Where possible, building the roads on the contour helps to overcome the slope.

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

Mu—Milford silty clay loam, pothole. This nearly level, very deep, very poorly drained soil is in potholes on recessional moraines, outwash plains, and till plains. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 11 inches thick. The subsurface layer is black silty clay loam about 4 inches thick. The subsoil is about 39 inches thick. It is mottled. It is dark gray, firm silty clay in the upper part and dark grayish brown and olive gray, firm silty clay loam in the lower part. The underlying material to a depth of 60 inches or more is olive gray, mottled silt loam. In places the soil has an overwash of light colored silt loam. In a few areas the subsoil has less clay. In some places the dark surface layer is more than 24 inches thick.

Included with this soil in mapping are areas of the very poorly drained Mahalasville and Treaty soils and the poorly drained Drummer soils in the slightly higher landscape positions at the edges of potholes. These soils have less clay in the upper part of the subsoil than the Milford soil. They make up about 15 percent of the unit.

The available water capacity is high in the Milford soil. Permeability is moderately slow. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface, mainly during the winter and spring. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is poorly suited to corn and soybeans. Wetness and the ponding are the major management concerns (fig. 9). Crusting is also a concern. Small grain planted in the fall is subject to severe damage during periods of prolonged ponding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover

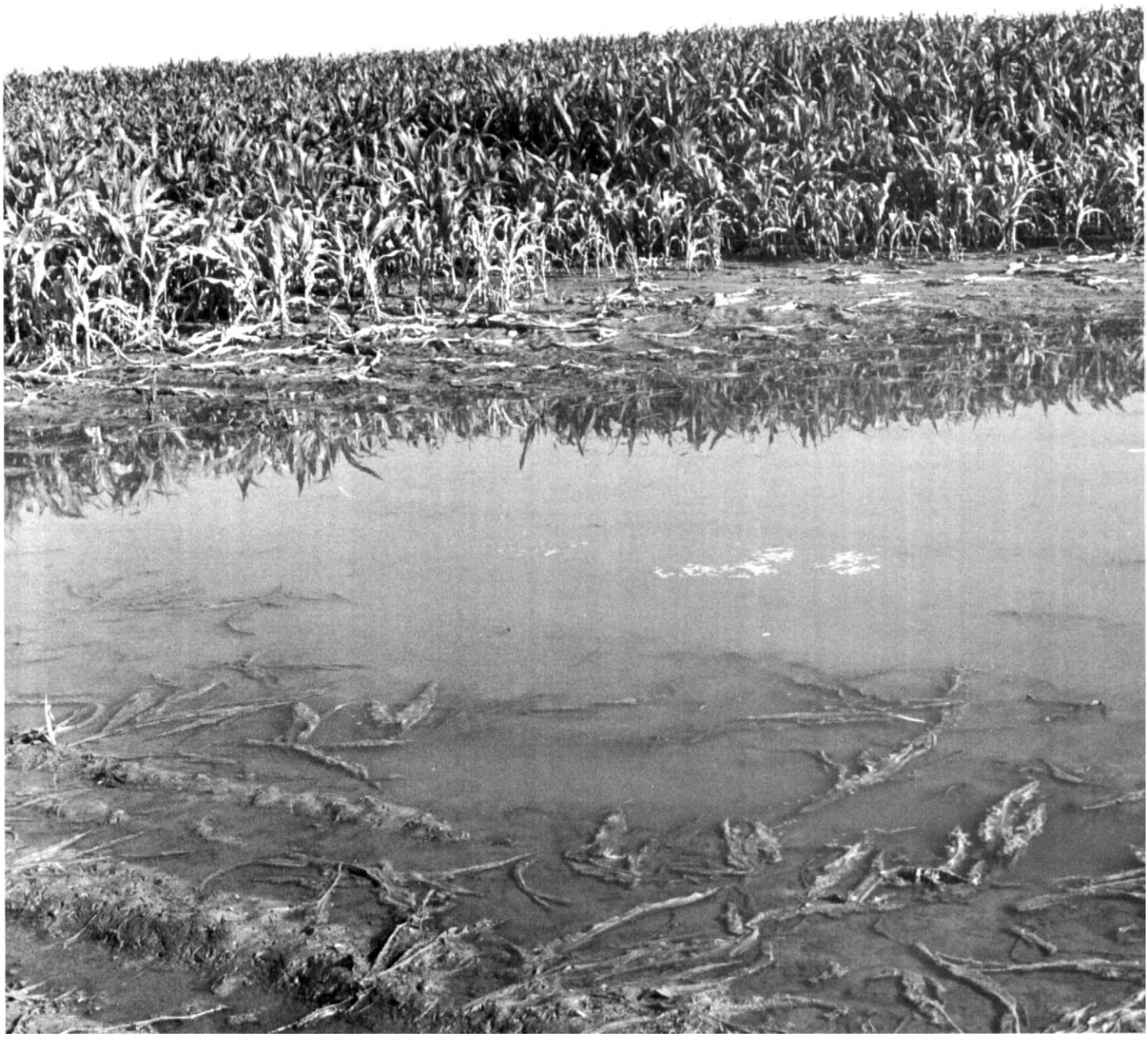


Figure 9.—Crop damage caused by ponding in an area of Milford silty clay loam, pothole. The corn in the background is in an area of Crosby-Miami complex, 2 to 6 percent slopes, eroded.

crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to fall moldboard, fall chisel, and ridge-till tillage systems.

This soil is fairly well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay. It is well suited to pasture. Wetness is a limitation, and ponding is a hazard. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet

can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the ponding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, the ponding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IVw. No woodland ordination symbol is assigned.

MwA—Mulvey silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on outwash plains. It is deep or very deep over gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 60 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is about 57 inches thick. It is mottled. It is yellowish brown, firm silt loam and silty clay loam in the upper part; dark yellowish brown, firm clay loam in the next part; and dark yellowish brown, firm gravelly sandy clay loam and grayish brown, friable gravelly sandy loam in the lower part. The underlying material to a depth of 80 inches or more is gray gravelly coarse sand. In places the dark surface layer is more than 10 inches thick. In a few small areas the thickness of the silty material is less than 24 inches or more than 40 inches. In a few places the surface layer is lighter colored.

Included with this soil in mapping are the moderately well drained Bowes Variant and well drained Bowes soils in the slightly higher lying areas. Also included, in depressions, are the very poorly drained Mahalasville soils that have a gravelly substratum. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Mulvey soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1 to 3 feet in winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness is a severe limitation if this soil is used as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

Mz—Muskego muck, drained. This nearly level, very deep, very poorly drained soil is in depressions on outwash plains, terraces, recessional moraines, and till plains. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is black muck about 10 inches thick. Below this, to a depth of 39 inches, is muck. It is black and friable in the upper part and very dark gray and firm in the lower part. The underlying material to a depth of 60 inches or more is dark olive gray coprogenous earth. In some areas overwash mineral material has been mixed with the surface layer. In a few small areas, mineral material is within a depth of 51 inches. In some places the organic material is more than 51 inches thick.

Included with this soil in mapping are areas of the

very poorly drained Mahalasville, Treaty, and Pella soils and the poorly drained Drummer soils in the slightly higher landscape positions at the edges of deep depressions. These soils formed in mineral material. Also included are some areas that have not been drained. Included areas make up about 15 percent of the unit.

The available water capacity is very high in the Muskego soil. Permeability is moderate or moderately rapid in the organic material and slow in the coprogenous earth. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is very high. The water table is at or above the surface from late fall through spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland or are idle land.

This soil is poorly suited to corn and soybeans. Wetness is the major limitation, and ponding and soil blowing are hazards. Small grain planted in the fall is subject to severe damage during periods of prolonged ponding. Subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage that leaves a protective cover of crop residue on the surface, planting buffer strips or vegetative barriers, or using a combination of these practices or by maintaining a permanent cover of vegetation. This soil is well suited to spring moldboard or spring chisel tillage systems if the new crop is planted into corn residue.

This soil is fairly well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay. It is well suited to pasture. Wetness is a limitation, and ponding and soil blowing are hazards. Subsurface drains and shallow surface drains can be used to remove excess water if adequate outlets are available. Growing grasses and legumes helps to control soil blowing. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding and subsidence, this soil is generally unsuited to use as a site for dwellings. Because of the ponding, the subsidence, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Replacing the organic material with a more suitable base material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IVw. The woodland ordination symbol is 2W.

OaB2—Oakville-Billett, moderately wet, complex, 2 to 6 percent slopes, eroded. This map unit consists of gently sloping, very deep soils on sand dunes. The Oakville soil is somewhat excessively drained and is on knolls, shoulder slopes, and the more sloping part of side slopes. The Billett soil is moderately well drained and is on toe slopes, in drainageways, and on the less sloping part of side slopes. Individual areas of this unit are elongated or irregularly shaped and range from 2 to 120 acres in size. They are about 50 percent Oakville soil and 35 percent Billett soil. The two soils occur as areas so intricately mixed or so small that it was not practical to map them separately.

Typically, the surface layer of the Oakville soil is dark brown loamy fine sand about 8 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil to a depth of 80 inches or more is dark yellowish brown and yellowish brown, friable and very friable loamy fine sand. In some areas the surface layer is darker. In a few places the lower part of the subsoil has more clay or bands.

Typically, the surface layer of the moderately wet Billett soil is very dark grayish brown fine sandy loam about 8 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil extends to a depth of 80 inches or more. It is dark yellowish brown and strong brown, friable fine sandy loam in the upper part and dark yellowish brown and light brownish gray, mottled, friable loamy fine sand and grayish brown, very friable loamy fine sand in the lower part. In some places the surface layer is lighter colored. In a few areas the subsoil has more clay. In a few places the dark surface

layer is more than 10 inches thick.

Included with these soils in mapping are areas of the somewhat poorly drained La Hogue soils. These included soils are in the less sloping areas and on toe slopes of dune ridges. They make up about 10 percent of the unit.

The available water capacity is low in the Oakville soil and moderate in the Billett soil. Permeability is rapid in the Oakville soil and moderately rapid in the Billett soil. Surface runoff is medium on both soils. The content of organic matter in the surface layer is moderately low. The Billett soil has a high water table at a depth of 3 to 6 feet in winter and early spring.

Most areas of these soils are used for cultivated crops. A few areas are used for hay or pasture.

These soils are poorly suited to corn, soybeans, and small grain. Water erosion and soil blowing are hazards. Droughtiness is a limitation. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, ridging at an angle to the prevailing wind, planting buffer strips or vegetative barriers, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion and soil blowing, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to no-till and ridge-till tillage systems and to spring chisel if the new crop is planted into corn residue.

These soils are fairly well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay. They are well suited to pasture. Water erosion and soil blowing are hazards. Droughtiness is a limitation. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control runoff, erosion, and soil blowing. Irrigation helps to overcome the droughtiness. Overgrazing and grazing when the soils are too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. The main management concerns in areas of the Oakville soil are the equipment limitation and seedling mortality. Plant competition is moderate in areas of the Billett soil. Equipment tends to bog down in sandy soils when they are dry. The equipment limitation can be reduced by delaying timber harvest until periods when the soil is moist or frozen. Site preparation, special planting stock, and overplanting help to overcome seedling mortality. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The Oakville soil is suitable for use as a site for dwellings and local roads and streets. The Billett soil is suitable for use as a site for dwellings without basements. The wetness of the Billett soil is a moderate limitation on sites for dwellings with basements. An adequate foundation drainage system is needed to lower the water table. Because of the potential for frost action, the Billett soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IVs. The woodland ordination symbol is 4S for the Oakville soil and 4A for the Billett soil.

OgA—Ockley silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on outwash plains and stream terraces. It is deep or very deep over very gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is brown silt loam about 11 inches thick. The subsoil is about 52 inches thick. It is dark yellowish brown, friable silt loam in the upper part; brown, firm clay loam in the next part; and brown, firm gravelly clay loam and dark brown, gravelly coarse sandy loam in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown very gravelly coarse sand. In some places the surface layer is darker. In a few small areas the lower part of the subsoil has less clay and less gravel.

Included with this soil in mapping are the well drained Kosciusko soils in the more sloping areas along terrace breaks. These soils have a solum that is less than 40 inches thick. They make up about 10 percent of the unit.

The available water capacity is high in the Ockley soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small

grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength and the shrink-swell potential, the soil is moderately limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

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

OmB2—Octagon silt loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on rises and breaks along drainageways on till plains and recessional moraines. It is moderately deep over compact glacial till. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is about 29 inches thick. It is dark yellowish brown, firm silty clay loam in the upper part and dark yellowish brown and yellowish brown, firm sandy clay loam in the lower part. The underlying material to a depth of 60 inches or more is brown fine sandy loam. In places the dark surface layer is more than 10 inches thick. In some areas the surface layer is lighter colored. In a few places the underlying compact glacial till is at a depth of less than 24 inches.

Included with this soil in mapping are the well drained Lauramie soils at the slightly higher elevations. These soils have a solum that is more than 40 inches thick. Also included are small areas of the somewhat poorly drained Millbrook and Toronto soils in drainageways and on toe slopes and soils that have slopes of more than 6 percent along drainageways and small breaks. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Octagon soil. Permeability is moderate in the solum and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes for hay and pasture helps to control erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is suitable for use as a site for dwellings. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

The land capability classification is IIe. No woodland ordination symbol is assigned.

OmC2—Octagon silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, well drained soil is in undulating areas and along drainageways on till plains and recessional moraines. It is moderately deep over

compact glacial till. Individual areas are long and narrow or irregularly shaped and range from 2 to 40 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. It contains brown material from the subsoil. The subsoil is 20 inches thick. It is brown and dark yellowish brown, firm clay loam in the upper part and yellowish brown, firm loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown fine sandy loam. In some areas the underlying compact glacial till is at a depth of less than 24 inches. In a few places the surface layer is lighter colored.

Included with this soil in mapping are the somewhat poorly drained Toronto and Millbrook soils on toe slopes and in drainageways and small areas of the well drained Lauramie soils on the upper part of side slopes. Lauramie soils have a solum that is more than 40 inches thick. Also included are a few small severely eroded areas that have a surface soil of silty clay loam or clay loam. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Octagon soil. Permeability is moderate in the solum and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems and to spring chisel if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The slope is a moderate limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

OpC3—Octagon clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, well drained soil is in undulating areas and along drainageways on till plains and recessional moraines. It is moderately deep over compact glacial till. In most areas, the original surface layer has been removed by erosion and tillage has mixed the rest with the upper part of the subsoil. Individual areas of this soil are long and narrow or irregularly shaped and range from 2 to 60 acres in size.

Typically, the surface layer is dark brown clay loam about 8 inches thick. The subsoil is 20 inches thick. It is dark yellowish brown, firm clay loam in the upper part and yellowish brown, firm loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown loam. In places the glacial till is silt loam. In some areas the underlying compact glacial till is at a depth of less than 24 inches. In a few places the surface layer is lighter colored.

Included with this soil in mapping are the somewhat poorly drained Millbrook and Toronto soils on toe slopes and in drainageways and small areas of the well drained Lauramie soils on the upper part of side slopes. Lauramie soils have a solum that is more than 40 inches thick. Also included are soils that have a cobbly surface layer. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Octagon soil. Permeability is moderate in the solum and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of

crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems and to spring chisel if the new crop is planted into corn residue.

This soil is fairly well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay. It is well suited to pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The slope is a moderate limitation if this soil is used as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

The land capability classification is IVe. No woodland ordination symbol is assigned.

Ou—Ouiatenon sandy loam, frequently flooded. This nearly level, somewhat excessively drained soil is on flood plains. It is deep over very gravelly sand, gravelly sand, and sand. It is subject to frequent flooding for brief periods from late fall through spring. Individual areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is very dark gray sandy loam about 6 inches thick. The subsurface layer is very dark gray, very friable loamy sand about 5 inches thick. The underlying material extends to a depth of 60 inches or more. It is dark brown loamy sand in the upper part and yellowish brown, stratified very gravelly sand, gravelly sand, and sand in the lower part. In places the upper part of the underlying material has more clay. In some areas the surface layer is lighter colored. In a few areas the upper part of the underlying material has more gravel.

Included with this soil in mapping are some moderately well drained soils, the somewhat poorly drained Ceresco soils, and the very poorly drained Cohoctah soils. These soils are in areas farther away from stream channels adjacent to uplands. Also included are some soils that have a gravelly or very gravelly surface layer. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Ouiatenon soil. Permeability is rapid in the upper part of the underlying material and very rapid in the lower part. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used as woodland. Some areas are used for cultivated crops or for hay or pasture.

This soil is fairly well suited to corn and soybeans, but damage from floodwaters can be expected. Flooding and soil blowing are major hazards, and droughtiness is a limitation. Small grain planted in the fall is subject to severe damage during periods of prolonged flooding. Late spring planting of adapted crops helps to minimize the damage or loss caused by flooding. Levees or dikes help to control flooding, but they are extremely expensive if properly constructed. Irrigation can overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing and scouring by floodwater, reduce the evaporation rate, and maintain or improve soil tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and spring chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture, but prolonged flooding can damage these crops from late fall through spring. Flooding and soil blowing are hazards, and droughtiness is a limitation. Levees and dikes help to control flooding. Growing grasses and legumes helps to control soil blowing. Irrigation can overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. The frequent flooding can delay planting and harvesting. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding, this soil is generally unsuited to use as a site for dwellings. The flooding is also a severe limitation on sites for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding.

The land capability classification is IIIs. The

woodland ordination symbol is 6A.

Ox—Ouiatenon loamy sand, occasionally flooded. This nearly level, somewhat excessively drained soil is on flood plains. It is deep over very gravelly coarse sand. It is subject to occasional flooding for brief periods from late fall through spring. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is very dark gray loamy sand about 12 inches thick. The subsurface layer is about 8 inches thick. It is very dark grayish brown, very friable loamy sand in the upper part and dark brown, very friable coarse sand in the lower part. The underlying material extends to a depth of 60 inches or more. It is dark brown coarse sand in the upper part and dark brown very gravelly coarse sand in the lower part. In places the upper part of the underlying material has more clay. In a few small areas the underlying material has less gravel. In some places the upper part of the underlying material has more gravel. In other places no carbonates are in the surface soil and the upper part of the underlying material. In some areas the surface layer is lighter colored.

Included with this soil in mapping are some moderately well drained soils, the somewhat poorly drained Ceresco soils, and the very poorly drained Cohoctah soils. These soils are in areas farther away from stream channels adjacent to uplands. Also included are soils that have a gravelly or very gravelly surface layer. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Ouiatenon soil. Permeability is rapid in the upper part of the underlying material and very rapid in the lower part. Surface runoff is slow. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for woodland, hay, or pasture.

This soil is fairly well suited to corn and soybeans, but damage from floodwaters can be expected. Flooding and soil blowing are major hazards, and droughtiness is a limitation. Small grain planted in the fall is subject to severe damage during periods of prolonged flooding. Late spring planting of adapted crops helps to minimize the damage or loss caused by flooding. Levees or dikes help to control flooding, but they are extremely expensive if properly constructed. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing and scouring by floodwater, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and spring chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture, but prolonged flooding can damage these crops from late fall through spring. Flooding and soil blowing are hazards, and droughtiness is a limitation. Levees and dikes help to control flooding. Growing grasses and legumes helps to control soil blowing. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing reduces plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. The occasional flooding can delay planting and harvesting. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding, this soil is generally unsuited to use as a site for dwellings. The flooding is also a severe limitation on sites for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding.

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

Oy—Ouiatenon fine sandy loam, sandy substratum, frequently flooded. This nearly level, very deep, somewhat excessively drained soil is on flood plains. It is subject to frequent flooding for brief or long periods during the winter and spring. Individual areas are elongated or irregularly shaped and range from 3 to 120 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsurface layer also is very dark grayish brown fine sandy loam. It is about 4 inches thick. The underlying material to a depth of 60 inches or more is dark brown loamy sand and sand. In places the underlying material has more clay. In a few small areas the underlying material contains gravel. In some areas the surface layer is lighter colored.

Included with this soil in mapping are the well drained Battleground and Lash soils in the lower lying areas on flood plains. These soils make up about 15 percent of the unit.

The available water capacity is low in the Ouiatenon soil. Permeability is rapid. Surface runoff is slow. The

content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for woodland, hay, or pasture.

This soil is fairly well suited to corn and soybeans, but damage from floodwaters can be expected. Flooding and soil blowing are major hazards, and droughtiness is a limitation. Small grain planted in the fall is subject to severe damage during periods of prolonged flooding. Late spring planting of adapted crops helps to minimize the damage or loss caused by flooding. Levees or dikes help to control flooding, but they are extremely expensive if properly constructed. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing and scouring by floodwater, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and spring chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops from late fall to spring. Flooding and soil blowing are hazards, and droughtiness is a limitation. Levees and dikes help to control flooding. Growing grasses and legumes helps to control soil blowing. Irrigation helps to overcome the droughtiness. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. The frequent flooding can delay planting and harvesting. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding, this soil is generally unsuited to use as a site for dwellings. The flooding is also a severe limitation on sites for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding.

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

Pc—Palms muck, drained. This nearly level, very deep, very poorly drained soil is in depressions on outwash plains, terraces, recessional moraines, and till plains. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 60 acres in size.

Typically, the surface layer is black muck about 10 inches thick. Below this, to a depth of 36 inches, is friable muck. It is very dark grayish brown in the upper part and dark gray in the lower part. The underlying material to a depth of 60 inches or more is dark gray silt loam. In places an overwash of mineral material has been mixed with the surface layer. In a few small areas, mineral layers are within a depth of 16 inches. In some places the organic material is more than 50 inches thick or is underlain by coprogenous earth.

Included with this soil in mapping are the very poorly drained Mahalasville, Treaty, and Pella soils and the poorly drained Drummer soils in the slightly higher landscape positions at the edges of deep depressions. These soils formed in mineral material. Also included are some areas that have not been drained. Included areas make up about 15 percent of the unit.

The available water capacity is very high in the Palms soil. Permeability is moderate or moderately rapid in the organic material and moderate in the underlying material. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is very high. The water table is at or above the surface from late fall through spring.

Most areas of this soil are used for cultivated crops. A few areas are idle land or are used for hay, pasture, or woodland.

This soil is fairly well suited to corn and soybeans. Wetness is a major limitation, and ponding and soil blowing are major hazards. Small grain planted in the fall is subject to severe damage during periods of prolonged ponding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage that leaves a protective cover of crop residue on the surface, planting buffer strips or vegetative barriers, or using a combination of these practices or by maintaining a permanent cover of vegetation. This soil is well suited to spring moldboard or spring chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation, and ponding and soil blowing are hazards. Growing grasses and legumes helps to control soil blowing. Shallow surface drains and subsurface drains can be used to remove excess water

if adequate outlets are available. Overgrazing reduces plant density. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of subsidence and the ponding, this soil is generally unsuited to use as a site for dwellings. Because of the ponding, subsidence, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Replacing the organic material with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Pd—Palms muck, gravelly substratum, undrained. This nearly level, very poorly drained soil is in depressions on glacial troughs and terraces. It is deep over gravelly coarse sand. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is black muck about 7 inches thick. Organic material extends to a depth of 42 inches. It is friable. The upper part is black muck, and the lower part is black muck that has thin strata of fine sand. The underlying material to a depth of 60 inches or more is gray gravelly coarse sand. In some places the soil has layers of fibers that are not as well decomposed. In other places an overwash of mineral material has been mixed with the surface layer. In a few small areas, mineral material is within a depth of 16 inches. In places the organic material is more than 50 inches thick or is underlain by coprogenous earth.

Included with this soil in mapping are areas of the very poorly drained Mahalasville soils that have a gravelly substratum. These soils are in the slightly higher landscape positions at the edge of depressions. They formed in mineral material. They make up about 15 percent of the unit.

The available water capacity is very high in the Palms soil. Permeability is moderately rapid in the organic material and very rapid in the underlying material. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is very high. The water table is at or above the surface from late fall through spring.

Most areas of this soil are undrained. They are idle land or are used as woodland.

Because of wetness and ponding, this soil is generally unsuited to cultivated crops and to hay crops and is poorly suited to pasture.

This soil is poorly suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding and subsidence, this soil is generally unsuited to use as a site for dwellings and is severely limited as a site for local roads and streets. Replacing the organic material with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding.

The land capability classification is Vw. The woodland ordination symbol is 2W.

Pg—Pella silty clay loam, pothole. This nearly level, very deep, very poorly drained soil is in potholes on outwash plains and till plains. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 200 acres in size.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer is black, firm silty clay loam about 5 inches thick. The subsoil is about 16 inches thick. It is olive gray, mottled, firm silty clay loam and silt loam. The underlying material to a

depth of 60 inches or more is grayish brown, mottled silt loam. It has strata of gravelly sandy loam in the lower part. In places the underlying material is loamy sand or gravelly loamy sand. In a few small areas the subsoil has more clay. In some areas the dark surface layer is more than 24 inches thick. In other areas glacial till is at a depth of less than 60 inches.

Included with this soil in mapping are small areas of the very poorly drained Mahalasville and Treaty soils and the poorly drained Drummer soils. These soils are in the slightly higher landscape positions at the edges of potholes. Mahalasville and Treaty soils have a solum that is more than 40 inches thick. Included soils make up about 10 percent of the unit.

The available water capacity is high in the Pella soil. Permeability is moderate. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface, mainly during the winter and spring. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is poorly suited to corn and soybeans. Wetness and the ponding are major management concerns. Crusting is also a concern. Small grain planted in the fall is subject to severe damage during periods of prolonged ponding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve soil tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to fall moldboard, fall chisel, and ridge-till tillage systems.

This soil is fairly well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay. It is well suited to pasture. The wetness and the ponding are concerns. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the ponding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, the ponding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IVw. No woodland ordination symbol is assigned.

Pk—Peotone silty clay loam, pothole. This nearly level, very deep, very poorly drained soil is in potholes on recessional moraines and till plains. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsurface layer is about 19 inches thick. It is black silty clay loam in the upper part and black silty clay in the lower part. The subsoil is about 26 inches thick. It is black, mottled, very firm silty clay in the upper part and dark grayish brown, mottled, very firm silty clay and firm silty clay loam in the lower part. The underlying material to a depth of 60 inches or more is olive gray silty clay loam. In places the soil has an overwash of lighter colored silt loam. In a few areas the subsoil has less clay. In some places the dark surface soil is less than 24 inches thick.

Included with this soil in mapping are small areas of the poorly drained Drummer soils. These soils are in the slightly higher landscape positions at the edges of potholes. They make up about 10 percent of the map unit.

The available water capacity is high in the Peotone soil. Permeability is moderately slow and slow in the solum and moderately slow in the underlying material. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface, mainly during the winter and spring. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is poorly suited to corn and soybeans. Wetness and the ponding are major management concerns. Crusting is also a concern. Small grain planted in the fall is subject to severe damage during periods of prolonged ponding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth,

infiltration, aeration, and the content of organic matter. This soil is well suited to fall moldboard, fall chisel, and ridge-till tillage systems.

This soil is fairly well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay. It is well suited to pasture. The wetness and the ponding are concerns. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the ponding and the shrink-swell potential, this soil is generally unsuited to use as a site for dwellings. Because of the shrink-swell potential, low strength, and the ponding, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding.

The land capability classification is IVw. No woodland ordination symbol is assigned.

PmB—Pinevillage gravelly sandy loam, 2 to 8 percent slopes, rarely flooded. This gently sloping and moderately sloping, very deep, well drained soil is on flood plains. It is subject to rare flooding for brief periods. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is dark brown gravelly sandy loam about 8 inches thick. The underlying material extends to a depth of 60 inches or more. It is dark brown gravelly sandy loam and very gravelly sandy loam in the upper part, dark brown gravelly loam in the next part, and dark yellowish brown gravelly loamy sand in the lower part. In places the underlying material has more clay. In a few areas the underlying material has less gravel. In some places the surface layer is thicker and darker. In a few areas the upper part of the underlying material has less clay and more sand.

Included with this soil in mapping are the well drained Lash, somewhat poorly drained Tice, and very poorly drained Sawabash soils. These soils are in the lower areas on flood plains. Lash soils have less gravel in the subsoil and underlying material than the Pinevillage soil. Also included are soils that have a cobbly surface layer. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Pinevillage soil. Permeability is moderately rapid. Surface runoff is medium. The content of organic matter in the surface layer is moderately low. The gravelly surface layer hinders tillage.

Most areas of this soil are used as woodland or for cultivated crops. Some areas are used for hay or pasture.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is a hazard, and droughtiness is a limitation. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems and to spring chisel if the new crop is planted into corn residue.

This soil is fairly well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay. It is well suited to pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer and during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation and seedling mortality. Planting seedlings by hand may be necessary because cobbles on the surface restrict the use of mechanical planters. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding, this soil is generally unsuited to use as a site for dwellings. Because of the flooding, the potential for frost action, and large stones, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and by frost action.

The land capability classification is IVs. The

woodland ordination symbol is 3F.

Pt—Pits, gravel. These nearly level to very steep, excessively drained to well drained areas are on uplands, terraces, and flood plains. The Pits were formed when gravel was mined from these areas. They range from 2 to 450 acres in size.

In most areas, the soil material has been removed and sand and gravel are exposed. In some areas, soil material has washed into the Pits and sparse vegetation is growing.

Included in mapping are piles of overburden, which have a cover of sparse vegetation. Also included, in the uplands, are small areas where glacial till has been exposed. A few of the Pits contain water in the lowest part.

The available water capacity is very low in the Pits. Permeability is rapid or very rapid. The content of organic matter is very low. Reaction ranges from neutral to moderately alkaline.

Most areas of this unit are barren, and erosion is a hazard. Major land reclamation is needed before the soils can support adequate vegetation.

Onsite investigation is needed if areas of this unit are to be used for building sites or local roads and streets. Major land reclamation is generally required.

No land capability classification or woodland ordination symbol is assigned.

RaB2—Rainsville silt loam, 2 to 6 percent slopes, eroded. This gently sloping, moderately well drained soil is on till plains and recessional moraines. It is deep over compact glacial till. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. It contains dark yellowish brown silty clay loam from the subsoil. The subsoil is about 45 inches thick. The upper part is dark yellowish brown, firm silty clay loam and clay loam; the next part is dark yellowish brown, firm sandy loam; and the lower part is dark yellowish brown and light olive brown, mottled, firm clay loam and loam. The underlying material to a depth of 60 inches or more is light olive brown loam. In a few places the soil has more than 20 inches of silty material. In some areas the depth to glacial till is more than 60 inches or less than 45 inches. In other areas the depth to mottles is more than 48 inches. In places the surface layer is darker.

Included with this soil in mapping are the somewhat poorly drained Fincastle and Starks soils on toe slopes. Also included are the well drained Miami soils on shoulder slopes and summits of knolls. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Rainsville soil. Permeability is moderate in the upper part of the solum, moderately slow in the lower part of the solum, and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 2.5 to 4.0 feet in winter and spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

This soil is suitable for use as a site for dwellings without basements. The wetness is a moderate limitation on sites for dwellings with basements. Installing subsurface drains helps to lower the water table. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

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

RcA—Raub-Brenton complex, 0 to 1 percent slopes. This map unit consists of nearly level, somewhat poorly drained soils on till plains. The Raub

soil is deep over compact glacial till, and the Brenton soil is very deep. Individual areas of this unit are irregular in shape and range from 2 to 100 acres in size. They are about 45 percent Raub soil and 35 percent Brenton soil. The two soils occur as areas so intricately mixed that it was not practical to map them separately.

Typically, the surface layer of the Raub soil is very dark grayish brown silt loam about 11 inches thick. The subsoil is about 42 inches thick. It is light olive brown and grayish brown, mottled, firm silty clay loam in the upper part; grayish brown, mottled, firm silt loam in the next part; and grayish brown and light olive brown, mottled, firm loam in the lower part. The underlying material to a depth of 60 inches or more is light olive brown, mottled loam. In places the dark surface layer is less than 10 inches thick. In some areas the underlying compact glacial till is at a depth of less than 40 inches. In a few small areas the soil has more than 40 inches of silty material. In some places stratified material is above the underlying glacial till.

Typically, the surface layer of the Brenton soil is very dark gray silt loam about 11 inches thick. The subsoil is about 41 inches thick. The upper part is olive brown, mottled, firm silty clay loam. The lower part is light olive brown, mottled, firm silt loam that has pockets and strata of sand and sandy loam. The underlying material to a depth of 60 inches or more is light olive brown, mottled silt loam that has strata of sand. In places the dark surface layer is less than 10 inches thick. In some areas glacial till is at a depth of less than 60 inches. In a few small areas the soil has more than 40 inches of silty material.

Included with these soils in mapping are the poorly drained Drummer soils in depressions and drainageways. Also included are the moderately well drained Throckmorton soils on slight rises. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Raub and Brenton soils. Permeability is moderate in the upper part of the solum in the Raub soil, moderately slow in the lower part of the solum, and slow in the underlying material. It is moderate in the Brenton soil. Surface runoff is slow on both soils. The content of organic matter in the surface layer is moderate. The water table in both soils is at a depth of 1 to 3 feet in winter and spring.

Most areas are used for cultivated crops. Some areas are used for hay or pasture.

These soils are well suited to corn, soybeans, and small grain. Wetness is a major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soils are too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The wetness is a severe limitation if these soils are used as sites for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soils are severely limited as sites for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soils to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIw. No woodland ordination symbol is assigned.

RdA—Richardville silt loam, 0 to 2 percent slopes. This nearly level, very deep, well drained soil is on till plains and recessional moraines. Individual areas are irregular in shape and range from 2 to 120 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 47 inches thick. It is dark yellowish brown, firm silty clay loam and clay loam in the upper part and yellowish brown, friable fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown fine sandy loam. In some areas the surface layer is darker. In places the underlying glacial till is at a depth of less than 40 inches. In a few areas the lower part of the subsoil has stratified sandy and gravelly material.

Included with this soil in mapping are the well drained Miami soils in the more sloping areas. These soils have a solum that is less than 40 inches thick. Also included are the somewhat poorly drained Fincastle and Starks soils at the slightly lower

elevations and in swales and small areas of the moderately well drained Rockfield soils in landscape positions similar to those of the Richardville soil. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Richardville soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of the shrink-swell potential and the potential for frost action, the soil is moderately limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

The land capability classification is I. The woodland ordination symbol is 7A.

RdB2—Richardville silt loam, 2 to 6 percent slopes, eroded. This gently sloping, very deep, well drained soil is on rises and breaks along drainageways on till plains and recessional moraines. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. It contains dark brown silty clay loam from the subsoil. The subsoil is about 44 inches thick. It is dark brown, firm clay loam and sandy clay loam in the upper part and dark yellowish brown, firm sandy clay loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown fine sandy loam. In some places the underlying glacial till is at a depth of less than 40 inches. In a few areas stratified sandy and gravelly material is in the lower part of the subsoil. In a few places the upper part of the subsoil has less clay and more sand. In places the surface layer is darker.

Included with this soil in mapping are the well drained Miami soils in the more sloping areas. These soils have a solum that is less than 40 inches thick. Also included are small areas of the somewhat poorly drained Fincastle and Starks soils along drainageways, on toe slopes, and in slight depressions and small severely eroded areas that have a surface soil of silty clay loam or clay loam. Included soils make up about 12 percent of the unit.

The available water capacity is high in the Richardville soil. Permeability is moderate. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this unit are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of the shrink-swell potential and the potential for frost action, the soil is moderately limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 7A.

RdC2—Richardville silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, very deep, well drained soil is on breaks along drainageways on till plains and recessional moraines. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. It contains yellowish brown silty clay loam from the subsoil. The subsoil is about 40 inches thick. It is yellowish brown, firm silty clay loam and dark yellowish brown, firm clay loam in the upper part and yellowish brown, firm clay loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown fine sandy loam. In some places the underlying glacial till is at a depth of less than 40 inches. In a few areas the lower part of the subsoil has stratified sandy and gravelly material. In a few places the upper part of the subsoil has less clay and more sand. In places the surface layer is darker.

Included with this soil in mapping are the well drained Miami soils in the more sloping areas. These soils have a solum that is less than 40 inches thick. Also included are small areas of the somewhat poorly drained Fincastle and Starks soils along drainageways, on toe slopes, and in slight depressions and small severely eroded areas that have a surface soil of silty clay loam or clay loam. Included soils make up about 12 percent of the unit.

The available water capacity is high in the Richardville soil. Permeability is moderate. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this unit are used for hay or pasture. Some areas are used for cultivated crops or as woodland.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems and to spring chisel if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The shrink-swell potential and the slope are moderate limitations if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. The buildings should be designed so that they conform to the natural slope of the land. Because of the shrink-swell potential, the slope, and the potential for frost action, the soil is moderately limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Where possible, constructing the roads on the contour reduces the amount of land grading needed to overcome the slope. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIIe. The woodland ordination symbol is 7A.

RoB—Rockfield silt loam, 1 to 3 percent slopes. This nearly level and gently sloping, moderately well drained soil is on rises on till plains. It is deep or very deep over compact glacial till. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is about 57 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the next part is dark yellowish brown, mottled, firm clay loam; and the lower part is light olive brown, mottled, firm loam. The underlying material to a depth of 80 inches or more is light olive brown, mottled loam. In places the surface layer is darker. In a few areas no outwash material is above the glacial till. In a few places the soil has strata of sandy material above the glacial till. In some areas the glacial till is fine sandy loam. In other areas the silty material is less than 24 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Fincastle and Starks soils in the more level landscape positions and in slight depressions. Also included are the well drained Miami soils on rises and in the more sloping areas and a few areas of the very poorly drained Mahalasville and Treaty soils in depressions and drainageways. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Rockfield soil. Permeability is moderate in the upper part of the solum, moderately slow in the lower part of the solum, and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 2.5 to 4.0 feet, mainly in winter and early spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Also, the wetness is a moderate limitation on sites for dwellings with basements. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Installing subsurface drains helps to lower the water table. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

RsF—Rodman gravelly loam, 25 to 60 percent slopes. This steep and very steep, excessively drained soil is on breaks of outwash plains and stream terraces. It is shallow over very gravelly coarse sand and coarse sand. Individual areas are long and narrow and range from 2 to 200 acres in size.

Typically, the surface layer is very dark gray gravelly loam about 5 inches thick. The subsurface layer is about 10 inches thick. It is very dark grayish brown gravelly loam in the upper part and dark brown, very friable very gravelly loamy coarse sand in the lower part. The underlying material to a depth of 60 inches or more is dark yellowish brown, stratified very gravelly coarse sand and coarse sand. In a few areas the underlying, stratified very gravelly coarse sand and coarse sand are at a depth of more than 15 inches or are exposed at the surface.

Included with this soil in mapping are the well drained Elston and Kalamazoo soils on the less sloping upper part of terrace breaks and narrow ridgetops. Also included are the well drained Strawn soils in landscape positions similar to those of the Rodman soil. Included soils make up about 15 percent of the unit.

The available water capacity is low in the Rodman

soil. Permeability is very rapid. Surface runoff also is very rapid. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used as woodland. A few small areas are used for pasture.

This soil is generally unsuited to cultivated crops. Erosion is a severe hazard. The slope makes the use of standard farm machinery difficult.

This soil is generally unsuited to grasses and legumes for hay and is poorly suited to pasture. It is droughty and produces little forage in summer. The slope makes the use of standard farm machinery difficult.

This soil is poorly suited to trees. The main management concerns are the hazard of erosion, the equipment limitation, and seedling mortality. Using selective cutting rather than clear cutting, establishing haul roads on the contour, and preserving as much understory vegetation as possible help to control erosion. Special operations, such as yarding logs uphill with cable, may be needed to minimize the use of rubber-tired and crawler tractors. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the slope, this soil is generally unsuited to use as a site for dwellings and is severely limited as a site for local roads and streets. Cuts and fills are needed. Where possible, building the roads on the contour helps to overcome the slope.

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

Rz—Ross silt loam, protected. This nearly level, very deep, well drained soil is on flood plains. It is protected from flooding by levees and pumps. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is very dark grayish brown and dark brown, friable loam, and the lower part is brown, friable sandy loam. In some places the dark surface soil and subsoil are less than 24 inches thick. In a few small areas the surface layer is calcareous. In places the lower part of the subsoil contains gravel.

Included with this soil in mapping are the well drained Allison and Battleground soils in the lower lying areas. These soils have less sand in the subsoil than the Ross soil. They make up about 10 percent of the unit.

The available water capacity is high in the Ross soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops.

This soil is well suited to corn, soybeans, and small grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of possible flooding caused by levee failure, this soil is generally unsuitable for use as a site for dwellings. Because of low strength, the flooding, and the potential for frost action, the soil is moderately limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and by frost action.

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

Sd—Saranac silty clay, gravelly substratum, occasionally flooded. This nearly level, very poorly drained soil is on flood plains. It is deep over gravelly loamy coarse sand. It is subject to occasional flooding for brief periods during the winter and spring. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 5 to 250 acres in size.

Typically, the surface layer is black silty clay about 10 inches thick. The subsurface layer is black, firm silty clay about 8 inches thick. The subsoil is about 31 inches thick. It is dark gray and gray, mottled, very firm silty clay in the upper part and grayish brown, mottled, firm silty clay loam in the lower part. The underlying material extends to a depth of 70 inches or more. The

upper part is dark gray, mottled silt loam. The lower part is light brownish gray gravelly loamy coarse sand that has strata of silt loam and gravelly loam. In a few small areas the dark surface layer is more than 24 inches thick. In some places the subsoil has less clay.

Included with this soil in mapping are the very poorly drained Cohoctah soils in the slightly higher positions on flood plains. These soils have less clay and more sand in the subsoil than the Saranac soil. Also included are the somewhat poorly drained Ceresco soils in areas adjacent to stream channels. Included soils make up about 10 percent of the unit.

The available water capacity is high in the Saranac soil. Permeability is moderately slow in the solum and rapid in the underlying material. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface during the winter and spring. The surface layer becomes cloddy and hard if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used as woodland.

This soil is fairly well suited to corn and soybeans, but damage from floodwaters can be expected. Wetness, the flooding, and the ponding are major management concerns. Crusting is also a concern. Levees or dikes help to control flooding, but they are extremely expensive if properly constructed. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring chisel and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops in winter and spring. The wetness, the ponding, and the flooding are concerns. Levees and dikes help to control flooding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The flooding and the wetness can delay planting and harvesting. Woodland management activities should be performed during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding and the ponding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, the flooding, and the ponding, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and by frost action.

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

Sf—Sawabash silty clay loam, frequently flooded. This nearly level, very deep, very poorly drained soil is on flood plains. It is subject to frequent flooding for brief or long periods from fall through spring. It is also frequently ponded by surface runoff from adjacent areas. Individual areas are long and narrow or irregularly shaped and range from 3 to 70 acres in size.

Typically, the surface layer is very dark grayish brown silty clay loam about 9 inches thick. The subsurface layer is very dark grayish brown and very dark gray silty clay loam about 37 inches thick. The subsoil is dark grayish brown, mottled, firm silty clay loam about 9 inches thick. The underlying material to a depth of 60 inches or more is dark gray, mottled silty clay loam. In a few areas the soil has a lighter colored overwash about 7 to 20 inches thick. In places the dark surface layer is less than 36 inches thick. In some areas the surface soil and the subsoil have more sand.

Included with this soil in mapping are the somewhat poorly drained Tice and well drained Battleground soils at the higher elevations adjacent to stream channels. These soils make up about 15 percent of the unit.

The available water capacity is high in the Sawabash soil. Permeability is moderate. Surface runoff is very slow or ponded. The content of organic matter in the

surface layer is high. The water table is at or above the surface, mainly from late fall through spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn and soybeans, but damage from floodwaters can be expected. Wetness, the flooding, and the ponding are major management concerns. Levees or dikes help to control flooding, but they are extremely expensive if properly constructed. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring chisel and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops from late fall through spring. The wetness, the ponding, and the flooding are concerns. Levees and dikes help to control flooding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation, seedling mortality, and plant competition. Frequent flooding can delay planting and harvesting. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding and the ponding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, the ponding, and the flooding, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and flooding.

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

ShB—Shadeland silt loam, 1 to 4 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on uplands. It is moderately deep over interbedded siltstone and shale bedrock. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 26 inches thick. It is brown, mottled, friable silt loam and firm silty clay loam in the upper part; brown and dark brown, mottled, firm clay loam in the next part; and strong brown, mottled, firm channery clay loam in the lower part. The underlying material to a depth of 60 inches or more is interbedded siltstone and shale bedrock. In the northeastern part of the county, the bedrock is New Albany black shale. In places bedrock is at a depth of less than 20 inches. In a few small areas, bedrock is at a depth of more than 40 inches. In places the surface layer is darker.

Included with this soil in mapping are small areas of the moderately well drained High Gap Variant soils in the more sloping positions along drainageways. Also included, in depressions and drainageways, are small areas of the very poorly drained Mahalasville soils that have a shale substratum. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Shadeland soil. Permeability is moderate in the upper part of the solum and moderately slow in the lower part. Surface runoff is medium. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 1 to 2 feet, mainly in winter and early spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation, and erosion is a major hazard. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of

crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. The wetness and the hazard of erosion are concerns. Subsurface drains can be used to remove excess water if adequate outlets are available. Growing grasses and legumes helps to control runoff and erosion. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation and plant competition. The equipment limitation can be reduced by performing woodland management activities during periods when the soil is relatively dry or is frozen. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness is a severe limitation if this soil is used as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

SmA—Sleeth loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on outwash plains and terraces. It is deep over gravelly sand. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is about 48 inches thick. It is brown and dark yellowish brown, mottled, firm loam in the upper part; gray, mottled, firm sandy clay loam in the next part; and dark gray and dark grayish brown, mottled, friable gravelly sandy loam and very friable gravelly loamy sand in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown, mottled gravelly sand. In places the surface layer is darker. In a few small areas the surface layer and the upper part of the subsoil have less sand. In some places glacial till is within a depth of 60 inches.

Included with this soil in mapping are small areas of the well drained Kalamazoo soils on slight rises and in the more sloping areas. Also included, in depressions, are small areas of the very poorly drained Mahalasville soils that have a gravelly substratum. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Sleeth soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 1 to 3 feet in winter and early spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. The wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness is a severe limitation if this soil is used as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base

material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

Sn—Sloan clay loam, occasionally flooded. This nearly level, very deep, very poorly drained soil is on flood plains. It is subject to occasional flooding for brief periods from fall through spring. It is also frequently ponded by surface runoff from adjacent areas. Individual areas are long and narrow and range from 2 to 200 acres in size.

Typically, the surface layer is black clay loam about 9 inches thick. The subsurface layer also is black clay loam. It is about 7 inches thick. The subsoil is about 28 inches thick. It is grayish brown, mottled, firm loam that has thin strata of sandy loam in the lower part. The underlying material to a depth of 60 inches or more is grayish brown, mottled sandy loam and gravelly loam. In a few areas the soil has a lighter colored overwash of silt loam or loam about 7 to 20 inches thick. In a few places glacial till is within a depth of 60 inches. In some areas the dark surface soil is more than 24 inches thick. In other areas the surface layer and subsoil have less sand or clay.

Included with this soil in mapping are the very poorly drained Cohoctah soils on the wider flood plains in areas downstream. These soils have less clay in the subsoil than the Sloan soil. They make up about 10 percent of the unit.

The available water capacity is high in the Sloan soil. Permeability is moderate. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface, mainly during the winter and spring. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn and soybeans, but damage from floodwater can be expected. Wetness, the flooding, and the ponding are major management concerns. Crusting is also a concern. Levees or dikes help to control flooding, but they are extremely expensive if properly constructed. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Diverting runoff from nearby upland areas helps to minimize the ponding. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Springs at the base of the steep breaks should be cut off with subsurface drains or diversions. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring chisel and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops in winter and spring. Levees and dikes help to control flooding. The wetness, the flooding, and the ponding are concerns. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. Occasional flooding can delay planting and harvesting. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding and the ponding, this soil is generally unsuited to use as a site for dwellings. Because of the ponding, the flooding, and low strength, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding, flooding, and low strength.

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

So—Sloan Variant silty clay loam, occasionally flooded. This nearly level, very poorly drained soil is on flood plains. It is moderately deep over siltstone and shale bedrock. It is subject to occasional flooding for brief or long periods from fall through spring. It is also ponded by surface runoff from adjacent areas.

Individual areas are irregular in shape and range from 10 to 220 acres in size.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsoil is about 23 inches thick. The upper part is black, mottled, firm silty clay loam, and the lower part is dark grayish brown, mottled, firm very channery sandy clay loam. Weathered interbedded siltstone and shale bedrock is at a depth of about 33 inches. In places the underlying bedrock is within a depth of 20 inches. In a few small areas the bedrock is at a depth of more than 40 inches. In some places the subsoil contains less sand or channers.

Included with this soil in mapping are small areas of the somewhat poorly drained Tice and very poorly drained Sawabash soils in the slightly higher positions on the landscape. Sawabash soils have less sand in the subsoil than the Sloan Variant soil. Also, they do not have bedrock within a depth of 60 inches. Also included are soils that have a channery surface layer. Included soils make up about 5 percent of the unit.

The available water capacity is low in the Sloan Variant soil. Permeability is moderate. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high. The water table is at or above the surface during the winter and spring. The surface layer becomes cloddy and hard to work if tilled when too wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn and soybeans, but damage from floodwater can be expected. Wetness, the ponding, and the flooding are major management concerns. Crusting is also a concern. Levees or dikes help to control flooding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Diverting runoff from nearby upland areas helps to minimize the ponding. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring chisel and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops in winter and spring. The wetness, the flooding, and the ponding are concerns. Levees and dikes help to control flooding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The main management concerns are the equipment limitation, seedling mortality, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding and the ponding, this soil is generally unsuited to use as a site for dwellings. Because of the potential for frost action, the ponding, and the flooding, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding, ponding, and frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

SrB—Sparta sand, 2 to 6 percent slopes. This gently sloping, very deep, excessively drained soil is in undulating areas on sand dunes. Individual areas are elongated or irregularly shaped and range from 2 to 40 acres in size.

Typically, the surface layer is very dark brown sand about 12 inches thick. The subsurface layer extends to a depth of 80 inches or more. It is very dark brown and dark brown, very friable sand in the upper part; dark yellowish brown and yellowish brown, very friable sand in the next part; and brown, very friable sand that has dark brown bands of loamy sand in the lower part. In places the lower part of the subsoil contains more clay or gravel. In a few small areas the subsurface layer does not have bands of loamy sand. In a few places the surface layer is lighter colored.

Included with this soil in mapping are small areas of the well drained Carmi and Elston soils and the well drained Billett soils that have a gravelly substratum. These soils are at the lower elevations. Also included are small areas that have slopes of more than 6 percent. Included areas make up about 10 percent of the unit.

The available water capacity is low in the Sparta soil. Permeability is rapid. Surface runoff is slow. The

content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland. A few areas are idle land.

This soil is poorly suited to corn, soybeans, and small grain. Soil blowing is a hazard, and droughtiness is a limitation. The hazard of soil blowing can be reduced by establishing windbreaks, using a system of conservation tillage, planting buffer strips or vegetative barriers, ridging at an angle to the prevailing wind, or using a combination of these practices or by maintaining a permanent cover of vegetation. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control soil blowing, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems and to spring chisel if the new crop is planted into corn residue.

This soil is fairly well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay. It is well suited to pasture. Soil blowing is a hazard, and droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control soil blowing. Overgrazing reduces plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer help to keep the pasture in good condition.

This soil is well suited to trees. The main management concern is seedling mortality. Site preparation, special planting stock, and overplanting help to overcome seedling mortality. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

This soil is suitable for use as a site for dwellings and local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 4S.

SrC—Sparta sand, 6 to 12 percent slopes. This moderately sloping, very deep, excessively drained soil is in undulating areas on sand dunes. Individual areas are elongated or irregularly shaped and range from 2 to 40 acres in size.

Typically, the surface layer is very dark brown, very friable sand about 12 inches thick. The subsurface layer extends to a depth of 80 inches or more. The upper part is yellowish brown sand, and the lower part is yellowish brown, very friable sand that has dark brown bands of loamy sand. In places the lower part of the subsoil has more clay or gravel. In a few small areas the subsurface layer does not have bands of loamy sand. In a few places the surface layer is lighter colored.

Included with this soil in mapping are small areas of the well drained Carmi and Elston soils and the well drained Billett soils that have a gravelly substratum. These soils are at the lower elevations. Also included are small areas that have slopes of more than 12 percent. Included areas make up about 10 percent of the unit.

The available water capacity is low in the Sparta soil. Permeability is rapid. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this soil are used for hay or pasture. Some areas are used for cultivated crops or as woodland. A few areas are idle land.

This soil is generally unsuited to corn, soybeans, and small grain. Soil blowing is a hazard, and droughtiness is a limitation.

This soil is poorly suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay. It is fairly well suited to pasture. Soil blowing is a hazard, and droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control soil blowing. Overgrazing reduces plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer help to keep the pasture in good condition.

This soil is well suited to trees. The main management concern is seedling mortality. Site preparation, special planting stock, and overplanting help to overcome seedling mortality. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The slope is a moderate limitation if this soil is used as a site for dwellings and local roads and streets. The buildings should be designed so that they conform to the natural slope of the land. Where possible, constructing the roads on the contour reduces the amount of land grading needed to overcome the slope.

The land capability classification is VIs. The woodland ordination symbol is 4S.

StC—Spinks fine sand, 6 to 12 percent slopes. This moderately sloping, very deep, well drained soil is in undulating areas on outwash plains, terraces, recessional moraines, and till plains. Individual areas are elongated or irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is dark brown fine sand about 9 inches thick. The subsurface layer is dark yellowish brown, very friable fine sand about 59 inches

thick. It has dark brown bands of friable loamy fine sand in the lower part. The underlying material to a depth of 80 inches or more is brown fine sand. In places the lower part of the subsoil contains less clay. In a few small areas the subsurface layer does not have bands of loamy fine sand. In a few places the surface layer is darker.

Included with this soil in mapping are areas of the well drained Alvin soils on toe slopes and in the more level areas. These soils have more clay in the upper part of the subsoil than the Spinks soil. Also included are the somewhat poorly drained Whitaker soils on toe slopes. Included soils make up about 10 percent of the unit.

The available water capacity is low in the Spinks soil. Permeability is rapid in the upper part of the solum, moderately rapid in the lower part of the solum, and rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is low.

Most areas of this soil are idle land. Some areas are used for cultivated crops, hay, pasture, or woodland.

This soil is fairly well suited to cultivated crops. Water erosion and soil blowing are hazards, and droughtiness is a limitation. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Irrigation helps to overcome the droughtiness. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion and soil blowing, reduce the evaporation rate, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems and to spring chisel if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as smooth bromegrass and alfalfa, for hay and pasture. Water erosion and soil blowing are hazards. Droughtiness is a limitation. Irrigation helps to overcome the droughtiness. Deep-rooted legumes and drought-tolerant species should be selected. Growing grasses and legumes helps to control runoff, erosion, and soil blowing. Overgrazing reduces plant densities. Proper stocking rates, rotation grazing, and restricted use during the summer help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation and seedling mortality. Equipment tends to bog down in sandy soils when they are dry. The equipment limitation can be reduced by delaying timber harvest until the soil is moist or frozen. Site preparation, special planting stock, and overplanting help to overcome seedling mortality. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The slope is a moderate limitation if this soil is used as a site for dwellings and local roads and streets. The buildings should be designed so that they conform to the natural slope of the land. Where possible, constructing the roads on the contour reduces the amount of land grading needed to overcome the slope.

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

SwA—Starks-Fincastle complex, 0 to 2 percent slopes. This map unit consists of nearly level, somewhat poorly drained soils on till plains. The Starks soil is very deep, and the Fincastle soil is deep over compact glacial till. The Fincastle soil is on slightly higher rises than the Starks soil. Individual areas of this unit are irregular in shape and range from 2 to 100 acres in size. Some broad areas are larger than 1,000 acres. The areas are about 50 percent Starks soil and 35 percent Fincastle soil. The two soils occur as areas so intricately mixed that it was not practical to map them separately.

Typically, the surface layer of the Starks soil is brown silt loam about 10 inches thick. The subsoil is about 46 inches thick. It is brown and yellowish brown, mottled, firm silty clay loam in the upper part and yellowish brown, firm silt loam and loam in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown, mottled sandy loam that has thin strata of loamy sand and pockets of silt loam. In places glacial till is at a depth of less than 60 inches. In a few areas the surface layer is darker. In a few places the silty material is more than 40 inches thick.

Typically, the surface layer of the Fincastle soil is dark grayish brown silt loam about 10 inches thick. The subsoil is about 44 inches thick. It is olive brown, dark yellowish brown, and yellowish brown, mottled, firm silt loam and silty clay loam in the upper part and yellowish brown, mottled, firm clay loam and loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, mottled loam. In places compact glacial till is at a depth of less than 40 inches. In a few areas the surface layer is darker. In some places the silty material is more than 40 inches thick. In other places the glacial till is fine sandy loam.

Included with these soils in mapping are the moderately well drained Rockfield soils on slight rises and in the more sloping areas along drainageways and the somewhat poorly drained Crosby soils on slight

rises. Crosby soils have more sand in the upper part of the subsoil than the major soils. Also, they have a solum that is less than 40 inches thick. Also included are small areas of the very poorly drained Treaty and Mahalasville soils in depressions and drainageways. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Starks and Fincastle soils. Permeability is moderate in the Starks soil. It is moderate in the upper part of the solum in the Fincastle soil, moderately slow in the lower part of the solum, and slow in the underlying material. Surface runoff is slow on both soils. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 1 to 3 feet in winter and early spring.

Most areas are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

These soils are well suited to corn, soybeans, and small grain. Wetness is the major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. The wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by cutting, spraying, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness is a severe limitation if these soils are used as sites for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soils are severely limited as sites for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soils to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

SyF—Strawn-Rodman complex, 18 to 50 percent slopes. This map unit consists of moderately steep to very steep soils on breaks of till plains. The Strawn soil is well drained and is on the upper part of slopes. It is shallow or moderately deep over compact glacial till. The Rodman soil is excessively drained and is on the lower, steeper part of slopes. It is shallow over very gravelly coarse sand and coarse sand. Individual areas of this unit are irregular in shape and are parallel to streams. They range from 2 to 900 acres in size. They are about 50 percent Strawn soil and 35 percent Rodman soil. The two soils occur as areas so intricately mixed that it was not practical to map them separately.

Typically, the surface layer of the Strawn soil is very dark grayish brown loam about 3 inches thick. The subsurface layer is brown loam about 6 inches thick. The subsoil is dark yellowish brown, firm loam about 7 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown loam. In a few areas the subsoil has less clay. In a few places the underlying compact glacial till is at a depth of more than 24 inches. In some areas the underlying glacial till is fine sandy loam or silt loam. In other areas the dark surface layer is thicker.

Typically, the surface layer of the Rodman soil is very dark gray gravelly sandy loam about 5 inches thick. The subsurface layer is about 10 inches thick. It is very dark grayish brown gravelly coarse sandy loam in the upper part and dark brown gravelly loamy coarse sand in the lower part. The underlying material to a depth of 60 inches or more is brown very gravelly coarse sand that has strata of coarse sand. In a few areas the underlying gravelly material is at a depth of more than 15 inches. In some places the underlying gravelly material is exposed at the surface.

Included with these soils in mapping are the well drained Elston soils on the lower part of side slopes. Elston soils have a solum that is more than 40 inches thick. Also included are very steep areas of well drained soils that have underlying compact glacial till at a depth of less than 10 inches and several areas where the underlying gravelly material has been bonded by calcium carbonate and other compounds into a hard mass (fig. 10). Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Strawn soil and low in the Rodman soil. Permeability is

Figure 10.—An outcropping of cemented sand and gravel in an area of Strawn-Rodman complex, 18 to 50 percent slopes.

moderate in the solum of the Strawn soil and moderately slow in the underlying material. It is very rapid in the Rodman soil. Surface runoff is very rapid on both soils. The content of organic matter in the surface layer is moderate.

Most areas of this unit are used as woodland. A few areas are used for pasture.

These soils are generally unsuited to cultivated crops and hay crops because of the slope and the severe hazard of erosion. They are poorly suited to pasture. The soils are droughty and produce little forage in the summer.

These soils are poorly suited to trees. The main management concerns are the hazard of erosion, the equipment limitation, and seedling mortality. In addition, plant competition is moderate in areas of the Strawn soil. Using selective cutting rather than clear cutting, establishing haul roads on the contour, and preserving as much understory vegetation as possible help to control erosion. Special operations, such as yarding logs uphill with a cable, may be needed to minimize the use of rubber-tired and crawler tractors. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Competing

vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the slope, these soils are generally unsuited to use as sites for dwellings and are severely limited as sites for local roads and streets. Cuts and fills are needed. Where possible, constructing the roads on the contour helps to overcome the slope.

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

TbA—Tecumseh silt loam, 0 to 2 percent slopes. This nearly level, very deep, well drained soil is on till plains. Individual areas are irregular in shape and range from 3 to 450 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer also is very dark grayish brown silt loam. It is about 5 inches thick. The subsoil is about 50 inches thick. It is dark yellowish brown, firm silty clay loam in the upper part; dark brown, firm clay loam, sandy clay loam, and fine sandy loam in the next part; and dark yellowish brown and yellowish brown, firm loam in the lower part. The underlying material to a depth of 80 inches or more is yellowish brown fine sandy loam. In places the dark surface layer is less than 10 inches thick. In a few areas the lower part of the subsoil or the underlying material has less clay and more sand. In some places the silty material is more than 40 inches thick.

Included with this soil in mapping are areas of moderately well drained soils in the slightly lower positions on the landscape. Also included are the well drained Lauramie soils in the more sloping areas on rises and along drainageways. Lauramie soils have more sand in the upper part of the subsoil than the Tecumseh soil. Included soils make up about 10 percent of the unit.

The available water capacity is high in the Tecumseh soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is I. No woodland ordination symbol is assigned.

TcA—Thackery silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on terraces and outwash plains. It is deep over gravelly sand. Individual areas are irregular in shape and range from 2 to 10 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is about 44 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the next part is dark yellowish brown, mottled, firm clay loam and sandy clay loam; and the lower part is dark brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches or more is grayish brown gravelly sand. In some places the silty material is more than 20 inches thick. In a few areas glacial till is within a depth of 60 inches.

Included with this soil in mapping are the somewhat poorly drained Waynetown soils at the lower elevations. Also included are the well drained Kalamazoo and Ockley soils on rises and in the more sloping areas and a few areas, in depressions and drainageways, of the very poorly drained Mahalasville soils that have a gravelly substratum. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Thackery soil. Permeability is moderate in the upper part of the solum, moderately rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 2.0 to 3.5 feet in winter and early spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness and the shrink-swell potential are moderate limitations if this soil is used as a site for dwellings without basements. The wetness is a severe limitation on sites for dwellings with basements. Foundations, footings, and basement walls should be strengthened. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of the potential for frost action, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

TfB—Throckmorton silt loam, 1 to 3 percent slopes. This nearly level and gently sloping, moderately well drained soil is on recessional moraines and till plains. It is deep over compact glacial till. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsoil is about 49 inches thick. The upper part is dark brown, firm silt loam and dark yellowish brown, firm silty clay loam; the next part is yellowish brown, mottled, firm silty clay loam and dark yellowish brown, mottled, firm clay loam; and the lower part is dark brown, mottled, firm sandy loam and brown, mottled, firm loam. The underlying material to a depth of 65 inches or more is yellowish brown, mottled loam. In some places the dark surface layer is 10 or more inches thick. In a few areas sandy material is above the underlying glacial till. In some areas the surface layer is lighter colored. In other areas the underlying compact glacial till is within a depth of 40 inches. In a few places the thickness of the silty material is more than 40 inches or less than 24 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Toronto and Millbrook soils and the well drained Mellott and Octagon soils. Toronto and Millbrook soils are in the more level areas and in depressions. Mellott soils are at the slightly higher elevations. Octagon soils are in the more sloping areas. Also included are a few areas of the poorly drained Drummer soils in depressions and drainageways. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Throckmorton soil. Permeability is moderate in the upper part of the solum, moderately slow in the lower part of the solum, and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderate. The water table is at a depth of 2.5 to 4.0 feet, mainly in winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Erosion is a hazard. Crusting is also a concern. Erosion and runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to no-till and ridge-till tillage systems. It is also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Erosion is a hazard. Growing grasses and legumes helps to control runoff and erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. In addition, the wetness is a moderate limitation on sites for dwellings with basements. Foundations, footings, and basement

walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Installing subsurface drains helps to lower the water table. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIe. No woodland ordination symbol is assigned.

Tg—Tice silty clay loam, frequently flooded. This nearly level, very deep, somewhat poorly drained soil is on flood plains. It is subject to frequent flooding for very brief to long periods during the winter and spring. Individual areas are long and narrow and range from 2 to 60 acres in size.

Typically, the surface soil is very dark grayish brown silty clay loam about 14 inches thick. The subsoil is dark brown, mottled, firm silty clay loam about 36 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown loam. In places the dark surface layer is more than 20 inches thick. In some areas the upper part of the subsoil has more sand. In a few places the surface layer and underlying material are calcareous throughout.

Included with this soil in mapping are the well drained Battleground soils in the higher areas. Also included are the very poorly drained Sawabash soils at the slightly lower elevations adjacent to uplands. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Tice soil. Permeability is moderate. Surface runoff is slow. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1.5 to 3.0 feet, mainly from late fall through spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is fairly well suited to corn and soybeans, but damage from floodwaters can be expected. Wetness and the flooding are major management concerns. Crusting is also a concern. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Dikes or levees help to control flooding, but they are extremely expensive if properly constructed. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring moldboard, spring chisel, and ridge-till tillage systems and to no-till if the new crop is planted in residue-cleared rows.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding can damage these crops from late fall through spring. The wetness and the flooding are concerns. Subsurface drains can be used to remove excess water if adequate outlets are available. Some areas can be protected from flooding by dikes and levees. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Frequent flooding can delay planting and harvesting. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the flooding, this soil is generally unsuited to use as a site for dwellings. In addition, the wetness is a severe limitation on sites for dwellings with basements. Because of low strength, the flooding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding and by frost action.

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

TmA—Toronto-Millbrook complex, 0 to 2 percent slopes. This map unit consists of nearly level, somewhat poorly drained soils on till plains. The Toronto soil is deep over compact glacial till, and the Millbrook soil is very deep. The Toronto soil is generally in slightly higher areas than the Millbrook soil. Individual areas of this unit are irregular in shape and generally range from 2 to 100 acres in size. Some broad areas are several hundred acres in size. The areas are about 45 percent Toronto soil and 35 percent Millbrook soil. The two soils occur as areas so intricately mixed that it was not practical to map them separately.

Typically, the surface layer of the Toronto soil is very dark grayish brown silt loam about 9 inches thick. The subsoil is about 43 inches thick. It is dark brown and

dark yellowish brown, mottled, firm silty clay loam and silty clay in the upper part and dark yellowish brown and yellowish brown, mottled, firm clay loam and loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, mottled loam. In places the surface layer is lighter colored. In some areas compact glacial till is at a depth of less than 40 inches. In a few small areas the soil has more than 40 inches of silty material. In some places stratified material is above the underlying glacial till. In some areas the underlying glacial till is either sandy loam or silt loam. In other areas the dark surface layer is 10 or more inches thick.

Typically, the surface layer of the Millbrook soil is very dark grayish brown silt loam about 9 inches thick. The subsoil is about 40 inches thick. The upper part is light olive brown, mottled, firm silty clay loam; the next part is yellowish brown, mottled, firm silty clay loam and loam; and the lower part is yellowish brown, mottled, firm loam that has pockets of loamy sand and sandy loam. The underlying material to a depth of 60 inches or more is yellowish brown, mottled silt loam that has strata of loamy sand. In places the surface layer is lighter colored. In some areas compact glacial till is at a depth of less than 60 inches. In a few small areas the soil has more than 40 inches of silty material. In some places the dark surface layer is 10 or more inches thick.

Included with these soils in mapping are the poorly drained Drummer soils in depressions and drainageways. Also included are the well drained Octagon soils on rises and in the more sloping areas along drainageways and the moderately well drained Throckmorton soils on slight rises. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Toronto and Millbrook soils. Permeability is moderate in the upper part of the solum in the Toronto soil, moderately slow in the lower part of the solum, and slow in the underlying material. It is moderate in the Millbrook soil. Surface runoff is slow on both soils. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1 to 3 feet in winter and spring.

Most areas are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

These soils are well suited to corn, soybeans, and small grain. Wetness is a major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. The wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The Millbrook soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the wetness, these soils are severely limited as sites for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soils are severely limited as sites for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIw. The woodland ordination symbol is 4A for the Millbrook soil. No woodland ordination symbol is assigned for the Toronto soil.

TnB2—Toronto-Octagon complex, 2 to 6 percent slopes, eroded. This map unit consists of gently sloping soils along drainageways on till plains and recessional moraines. The somewhat poorly drained Toronto soil is on toe slopes, in drainageways, and on the less sloping part of side slopes. It is deep over compact glacial till. The well drained Octagon soil is on knolls, shoulder slopes, and the more sloping part of side slopes. It is moderately deep over compact glacial till. Individual areas of this unit are irregular in shape and range from 2 to 80 acres in size. They are about 45 percent Toronto soil and 40 percent Octagon soil. The two soils occur as areas so intricately mixed or so small that it was not practical to map them separately.

Typically, the surface layer of the Toronto soil is very dark grayish brown silt loam about 9 inches thick. It contains dark yellowish brown material from the subsoil.

The subsoil is about 33 inches thick. The upper part is dark yellowish brown, mottled, firm silty clay loam, and the lower part is olive brown and light olive brown, mottled, firm clay loam and loam. The underlying material to a depth of 60 inches or more is light olive brown, mottled loam. In places the surface layer is lighter colored. In a few areas the soil has less than 22 inches of silty material. In some places the depth to the underlying compact glacial till is less than 40 inches. In other places a thin layer of stratified material is above the glacial till. In some areas the glacial till is either silt loam or fine sandy loam.

Typically, the surface layer of the Octagon soil is very dark grayish brown silt loam about 8 inches thick. It contains dark yellowish brown material from the subsoil. The subsoil is about 18 inches thick. It is dark yellowish brown, firm clay loam in the upper part and yellowish brown, firm loam in the lower part. The underlying material to a depth of 60 inches or more is light olive brown loam. In places the surface layer is lighter colored. In a few areas the depth to the underlying compact glacial till is less than 24 inches. In some places stratified material is above the glacial till. In other places the glacial till is either silt loam or fine sandy loam.

Included with these soils in mapping are the poorly drained Drummer soils in depressions and drainageways and the somewhat poorly drained Millbrook soils in landscape positions similar to those of the Toronto soil. Millbrook soils are underlain by stratified material. Also included are severely eroded areas where the surface soil is silty clay loam or clay loam and areas of the well drained Lauramie and moderately well drained Throckmorton soils. Lauramie and Throckmorton soils are on the upper part of side slopes. Lauramie soils have a solum that is more than 40 inches thick. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Toronto soil and moderate in the Octagon soil. Permeability is moderate in the upper part of the solum in the Toronto soil, moderately slow in the lower part of the solum, and slow in the underlying material. It is moderate in the subsoil of the Octagon soil and slow in the underlying material. Surface runoff is medium on both soils. The content of organic matter in the surface layer is moderate. The water table is at a depth of 1 to 3 feet in winter and spring in the Toronto soil.

Most areas are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

These soils are well suited to corn, soybeans, and small grain. Erosion is a hazard. Wetness is a limitation in areas of the Toronto soil. Crusting is also a concern. Subsurface drains are needed in some areas of the Toronto soil on toe slopes and in drainageways. Erosion and surface runoff can be controlled by diversions, terraces, water- and sediment-control basins, cover crops, green manure crops, grade-stabilization structures, and crop rotations that include grasses and legumes. Grassed waterways help to control erosion in the drainageways. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control erosion, help to prevent crusting, and maintain or improve tilth, infiltration, aeration, and the content of organic matter. These soils are well suited to no-till and ridge-till tillage systems. They are also well suited to spring moldboard and chisel tillage systems if the new crop is planted into corn residue.

These soils are well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Erosion is a hazard. Subsurface drains are needed in some areas of the Toronto soil on toe slopes and in drainageways. Growing grasses and legumes helps to control surface runoff and erosion. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The wetness is a severe limitation if the Toronto soil is used as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. The Octagon soil is suitable for use as a site for dwellings with or without basements. Because of low strength, the Toronto and Octagon soils are severely limited as sites for local roads and streets. The potential for frost action is an additional concern in areas of the Toronto soil. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is IIe. No woodland ordination symbol is assigned.

TtA—Troxel silty clay loam, 0 to 2 percent slopes. This nearly level, very deep, well drained soil is in depressions on outwash plains and terraces. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is black silty clay loam

about 12 inches thick. The subsurface layer is about 30 inches thick. It is black silty clay loam in the upper part and black clay loam in the lower part. The subsoil extends to a depth of 80 inches or more. It is brown, firm loam in the upper part; dark yellowish brown, friable fine sandy loam and sandy loam in the next part; and brown, loose gravelly coarse sand in the lower part. In some places the dark surface soil is less than 24 inches thick. In a few areas the upper part of the subsoil has more sand and less clay. In a few places the dark surface soil is more than 45 inches thick.

Included with this soil in mapping are small areas of the well drained Carmi and Elston soils and the well drained Billett soils that have a gravelly substratum. These soils are at the higher elevations. They have less clay and more sand in the subsoil than the Troxel soil and have a dark surface layer less than 24 inches thick. They make up about 15 percent of the unit.

The available water capacity is very high in the Troxel soil. Permeability is moderate. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is high.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn and soybeans. It is only fairly well suited to fall-planted small grain crops because of the ponding, which occurs during periods when the ground is frozen. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture, but prolonged ponding can damage these crops when the ground is frozen. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the ponding, this soil is generally unsuited to use as a site for dwellings. Because of low strength, the ponding, and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent damage caused by ponding and by frost action.

The land capability classification is I. No woodland ordination symbol is assigned.

Ua—Udorthents, loamy. These nearly level to very steep, very poorly drained to well drained soils are in disturbed areas on uplands, outwash plains, terraces, and flood plains. They are around highways and highway interchanges, shopping centers, sanitary landfills, and factories. In some places, deep cuts have been made in the original land surface and the soil material has been used as fill in the lower lying areas. In other places the soil material has been removed and used as fill for highway grades or for other uses. Individual areas range from 3 to 300 acres in size.

Typically, these soils are a mixture of surface soil, subsoil, and underlying material. The texture is silt loam, silty clay loam, clay loam, loam, and sandy loam. Waste material may be mixed in.

Included in mapping are small areas of undisturbed soils. Also included are areas where sandy or gravelly material has been used as fill material. Highways, streets, buildings, and parking lots cover much of the surface in some areas.

The available water capacity is very low to moderate in the Udorthents. Permeability is slow to moderate. Surface runoff ranges from very slow to rapid. The content of organic matter in the surface layer is very low. The depth to the water table ranges from at or near the surface to below a depth of 6 feet. Reaction ranges from strongly acid to moderately alkaline.

Most areas support a permanent cover of grasses, low-growing shrubs, or trees. Many areas are surrounded by heavily traveled highways. Erosion is the major management concern. Special management is needed. An intensified fertility program with special emphasis on the incorporation of organic residue or manure is needed if the soils are used for crops. Diversions, box inlet structures, grade-stabilization structures, and grassed waterways help to control erosion in gently sloping to very steep areas. Exposed areas should be revegetated as soon as possible after construction.

Onsite investigation is needed if these soils are to be used as building sites or for local roads and streets. Because the soil material is variable, engineering test data should be collected. The soil properties that affect the design of a structure vary within short distances.

No land capability classification or woodland ordination symbol is assigned.

UbB—Urban land-Billett, gravelly substratum, complex, 2 to 8 percent slopes. This map unit consists of areas of Urban land and the gently sloping, well drained Billett soil on outwash plains and terraces. The Billett soil is deep over gravelly coarse sand. Individual

areas of this unit range from 60 to 170 acres in size. They are about 50 percent Urban land and 40 percent Billett soil. The Urban land and the Billett soil occur as areas so intricately mixed that it was not practical to map them separately.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the original soil is not possible.

The Billett soil has a gravelly substratum. Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is about 35 inches thick. It is dark yellowish brown and dark brown, friable loam and sandy loam in the upper part and dark brown, very friable loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown gravelly coarse sand. In places the dark surface layer is more than 10 inches thick. In a few areas the subsoil has more gravel. In some places the upper part of the subsoil has less sand.

Included in mapping are areas of the well drained Troxel soils in depressions. These soils have more clay and less sand in the subsoil than the Billett soil and have a dark surface layer more than 24 inches thick. Also included are more sloping areas along drainageways and slope breaks. Included areas make up about 10 percent of the unit.

The available water capacity is moderate in the Billett soil. Permeability is moderately rapid in the upper part of the solum, rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this unit are used for dwellings. A few areas are idle land or are used for recreational facilities.

This unit is not used for crops, forage, or woodland. If trees and shrubs are planted, competing plants should be controlled until seedlings are established.

The Billett soil is suitable as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

No land capability classification or woodland ordination symbol is assigned.

UcA—Urban land-Carmi complex, 0 to 2 percent slopes. This map unit consists of areas of Urban land and the nearly level, well drained Carmi soil on outwash plains and terraces. The Carmi soil is deep over gravelly coarse sand. Individual areas of this unit range from 30 to more than 1,000 acres in size. They are about 55 percent Urban land and 35 percent Carmi soil. The Urban land and the Carmi soil occur as areas so intricately mixed that it was not practical to map them separately.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification is not possible.

Typically, the surface layer of the Carmi soil is very dark gray loam about 12 inches thick. The subsoil is about 35 inches thick. It is dark brown, firm loam in the upper part; dark brown, firm gravelly loam and gravelly sandy loam in the next part; and dark brown, very friable gravelly loamy sand in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown gravelly coarse sand. In places the dark surface layer is less than 10 inches thick. In some areas the upper part of the subsoil has less sand. In a few places the subsoil has less gravel.

Included in mapping are the well drained Troxel soils in depressions. These soils have more clay and less sand in the subsoil than the Carmi soil and have a dark surface layer more than 24 inches thick. They make up about 10 percent of the unit.

The available water capacity is moderate in the Carmi soil. Permeability is moderately rapid in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this unit are used for dwellings. A few areas are idle land or are used for recreational facilities.

This unit is not used for crops, forage, or woodland. If trees and shrubs are planted, competing plants should be controlled until seedlings are established.

The Carmi soil is suitable for use as a site for dwellings. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

No land capability classification or woodland ordination symbol is assigned.

UmB—Urban land-Miami complex, 2 to 8 percent slopes. This map unit consists of areas of Urban land and the gently sloping and moderately sloping, well drained Miami soil on till plains and recessional moraines. The Miami soil is moderately deep over compact glacial till. Individual areas of this unit range from 5 to 400 acres in size. They are about 45 percent Urban land and 40 percent Miami soil. The Urban land and the Miami soil occur as areas so intricately mixed that it was not practical to map them separately.

The Urban land is covered by streets, parking lots,

buildings, and other structures that so obscure or alter the soils that identification of the original soil is not possible.

Typically, the surface layer of the Miami soil is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 26 inches thick. It is dark yellowish brown, friable silty clay loam in the upper part and dark yellowish brown, firm clay loam and loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown loam. In places compact glacial till is at a depth of less than 24 inches. In some areas stratified material is above the glacial till.

Included in mapping are the somewhat poorly drained Crosby, Fincastle, and Starks soils on toe slopes and in drainageways. Also included are the well drained Richardville soils in landscape positions similar to those of the Miami soil. Richardville soils have a solum that is more than 40 inches thick. Included soils make up about 15 percent of the unit.

The available water capacity is moderate in the Miami soil. Permeability is moderate in the upper part of the subsoil, moderately slow in the lower part of the subsoil, and slow in the underlying material. Surface runoff is medium. The content of organic matter in the surface layer is moderately low.

Most areas of this unit are used for dwellings. A few areas are idle land or are used for recreational facilities.

This unit is not used for crops, forage, or woodland. If trees and shrubs are planted, competing plants should be controlled until seedlings are established.

The shrink-swell potential is a moderate limitation if the Miami soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

No land capability classification or woodland ordination symbol is assigned.

UmC—Urban land-Miami complex, 8 to 15 percent slopes. This map unit consists of areas of Urban land and the moderately sloping and strongly sloping, well drained Miami soil on till plains and recessional moraines. The Miami soil is moderately deep over compact glacial till. Individual areas of this unit range from 5 to 250 acres in size. They are about 45 percent Urban land and 40 percent Miami soil. The Urban land and the Miami soil occur as areas so intricately mixed that it was not practical to map them separately.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the original soil is not possible.

Typically, the surface layer of the Miami soil is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is yellowish brown, friable silt loam about 5 inches thick. The subsoil is about 28 inches thick. It is yellowish brown and dark yellowish brown, firm silty clay loam in the upper part and light olive brown, firm clay loam in the lower part. The underlying material to a depth of 60 inches or more is light olive brown loam. In places compact glacial till is at a depth of less than 24 inches. In some areas stratified material is above the glacial till.

Included in mapping are the somewhat poorly drained Crosby, Fincastle, and Starks soils on toe slopes and in drainageways. Also included are the well drained Richardville soils in landscape positions similar to those of the Miami soil. Richardville soils have a solum that is more than 40 inches thick. Included soils make up about 11 percent of the unit.

The available water capacity is moderate in the Miami soil. Permeability is moderate in the upper part of the subsoil, moderately slow in the lower part of the subsoil, and slow in the underlying material. Surface runoff is medium or rapid. The content of organic matter in the surface layer is moderately low.

Most areas of this unit are used for dwellings. A few areas are idle land or are used for recreational facilities.

This unit is not used for crops, forage, or woodland. If trees and shrubs are planted, competing plants should be controlled until seedlings are established.

The shrink-swell potential and the slope are moderate limitations if the Miami soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. The buildings should be designed so that they conform to the natural contour of the land. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic.

No land capability classification or woodland ordination symbol is assigned.

UsA—Urban land-Starks-Fincastle complex, 0 to 2 percent slopes. This map unit consists of areas of Urban land and the nearly level, somewhat poorly drained Starks and Fincastle soils on till plains. The Starks soil is very deep, and the Fincastle soil is deep over compact glacial till. Individual areas of this unit are

broad and are more than 1,000 acres in size. They are about 45 percent Urban land, 25 percent Starks soil, and 15 percent Fincastle soil. The Urban land and the Starks and Fincastle soils occur as areas so intricately mixed that it was not practical to map them separately.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the original soil is not possible.

Typically, the surface layer of the Starks soil is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is grayish brown, friable silt loam about 9 inches thick. The subsoil is about 48 inches thick. It is dark yellowish brown and yellowish brown, mottled, firm silty clay loam in the upper part; yellowish brown, mottled, firm clay loam in the next part; and dark gray, mottled, firm clay loam and sandy clay loam in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown, mottled loamy sand. In places the soil has more than 40 inches of silty material. In a few areas the surface layer is darker. In some places glacial till is within a depth of 60 inches.

Typically, the surface layer of the Fincastle soil is very dark gray silt loam about 4 inches thick. The subsurface layer is light brownish gray silt loam about 4 inches thick. The subsoil is about 38 inches thick. It is light brownish gray, mottled, friable silt loam in the upper part; yellowish brown, mottled, firm silty clay loam in the next part; and yellowish brown, mottled, firm clay loam in the lower part. The underlying material to a depth of 60 inches or more is yellowish brown, mottled loam. In places the soil has more than 40 inches of silty material. In some areas stratified material is above the glacial till. In some places the subsoil has more clay. In a few areas the surface layer is darker.

Included in mapping are the somewhat poorly drained Crosby soils, the moderately well drained Rockfield soils, the very poorly drained Treaty and Mahalasville soils, and the well drained Miami soils. Crosby soils are at the slightly higher elevations and have a solum that is less than 40 inches thick. Treaty and Mahalasville soils are in shallow depressions and drainageways. Miami soils are in the higher, more convex areas. Also included, in depressions, are many areas of very poorly drained soils that have been covered by fill material and leveled. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Starks and Fincastle soils. Permeability is moderate in the Starks soil. It is moderate in the upper part of the solum in the Fincastle soil, moderately slow in the lower part of the solum, and slow in the underlying material. Surface runoff is slow on both soils. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 1 to 3 feet during the winter and early spring.

Most areas of this unit are used for dwellings. A few areas are idle land or are used for recreational facilities.

This unit is not used for crops, forage, or woodland. If trees and shrubs are planted, competing plants should be controlled until seedlings are established.

The wetness is a severe limitation if the Starks and Fincastle soils are used as sites for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, the soils are severely limited as sites for local roads and streets. Strengthening the base material for roads and streets or replacing it with a more suitable base material improves the ability of the soils to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

No land capability classification or woodland ordination symbol is assigned.

Wb—Wallkill silt loam, coprogenous earth substratum. This nearly level, very deep, very poorly drained soil is in depressions on outwash plains, recessional moraines, and till plains. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is dark gray, firm silt loam about 17 inches thick. Below this, to a depth of 54 inches, is muck. The upper part is black and firm, and the lower part is dark reddish brown and friable. The underlying material to a depth of 60 inches or more is very dark grayish brown coprogenous earth. In some areas overwash mineral material is less than 16 inches or more than 40 inches thick. In a few areas the organic material extends to a depth of more than 60 inches. In a few places mineral material is below the coprogenous earth within a depth of 60 inches.

Included with this soil in mapping are areas of the very poorly drained Mahalasville, Treaty, and Pella soils and the poorly drained Drummer soils in the slightly higher positions at the edges of deep depressions. These soils formed in mineral material. Also included are some areas that have not been drained. Included areas make up about 15 percent of the unit.

The available water capacity is very high in the Wallkill soil. Permeability is moderately slow in the mineral material, moderately slow to moderately rapid in the organic material, and slow in the underlying

coprogenous earth. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is moderately low or moderate. The water table is at or above the surface during the winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland. Some areas are idle land.

This soil is fairly well suited to corn and soybeans. Wetness and the ponding are major management concerns. Crusting is also a concern. Small grain planted in the fall is subject to severe damage during periods of prolonged ponding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to fall moldboard, fall chisel, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation, and ponding is a hazard. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding, this soil is generally unsuited to use as a site for dwellings. In addition, low strength is a severe limitation on sites for dwellings without basements. Because of the ponding and the potential for frost action, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

We—Washtenaw silt loam. This nearly level, very deep, very poorly drained soil is in depressions on recessional moraines and till plains. It is frequently ponded by surface runoff from adjacent areas. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is brown silt loam about 10 inches thick. The substratum, to a depth of about 23 inches, is dark grayish brown silt loam. Below this is a buried soil. The surface layer of the buried soil is very dark gray, firm silty clay loam about 8 inches thick. The subsoil is about 34 inches thick. It is dark gray, mottled, firm silty clay loam in the upper part and gray, mottled, firm clay loam and loam in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown, mottled loam. In some areas the light colored overwash material is less than 20 inches or more than 40 inches thick. In places the overwash material is darker.

Included with this soil in mapping are small areas of the well drained Miami soils, the somewhat poorly drained Crosby soils, and the very poorly drained Mahalasville and Treaty soils in the slightly higher positions at the edges of deep depressions. Mahalasville and Treaty soils do not have a buried soil. Included soils make up about 10 percent of the unit.

The available water capacity is high in the Washtenaw soil. Permeability is moderate in the overwash material and slow in the buried soil. Surface runoff is very slow or ponded. The content of organic matter in the surface layer is moderate. The water table is at or above the surface, mainly during the winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn and soybeans. Wetness and the ponding are major management concerns. Crusting is also a concern. Small grain planted in the fall is subject to severe damage during periods of prolonged ponding. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Small enclosed depressions can be drained with an open inlet pipe in conjunction with subsurface drainage. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops

help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to fall moldboard, fall chisel, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation, and ponding is a hazard. Shallow surface drains and subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are the equipment limitation, seedling mortality, the windthrow hazard, and plant competition. The equipment limitation is caused by wetness. The wetness can be overcome by performing woodland management activities during periods when the soil is relatively dry or is frozen. Site preparation, special planting stock, and overstocking help to overcome seedling mortality. Species that tolerate wetness should be planted. Using harvest methods that do not leave the remaining trees isolated or widely spaced helps to overcome the windthrow hazard. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

Because of the ponding, this soil is generally unsuited to use as a site for dwellings. The ponding and the potential for frost action are severe limitations on sites for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and by frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

WgA—Waupecan silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on outwash plains. It is deep or very deep over gravelly sand. Individual areas are irregular in shape and range from 3 to 350 acres in size.

Typically, the surface layer is very dark gray silt loam about 11 inches thick. The subsoil is about 50 inches thick. It is dark brown, friable silt loam in the upper part; dark yellowish brown, firm silty clay loam in the next part; and dark brown, firm sandy loam and very friable loamy sand in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown gravelly sand. In places the dark surface layer is less than 10 inches thick. In a few areas the silty material is less than 28 inches thick. In some places the dark surface soil is more than 20 inches thick.

Included with this soil in mapping are small areas of the moderately well drained, moderately wet Waupecan soils; the somewhat poorly drained Lafayette soils; and the very poorly drained Mahalasville soils that have a gravelly substratum. The moderately wet Waupecan soils and the Lafayette soils are in the slightly lower positions on the landscape. The Mahalasville soils are in depressions. Also included, on rises and in the more sloping areas, are the well drained Longlois soils. Longlois soils have more sand in the upper part of the subsoil than the Waupecan soil. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Waupecan soil. Permeability is moderate in the upper part of the solum, moderately rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is I. No woodland ordination symbol is assigned.

WhA—Waupecan silt loam, moderately wet, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on outwash plains. It is deep or very deep over gravelly coarse sand. Individual areas are irregular in shape and range from 3 to 250 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer also is very dark grayish brown silt loam. It is about 5 inches thick. The subsoil is about 43 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the next part is yellowish brown, mottled, firm silty clay loam and clay loam; and the lower part is grayish brown and dark grayish brown, mottled, firm sandy loam and gravelly sandy loam. The underlying material to a depth of 60 inches or more is light gray gravelly coarse sand. In places the dark surface layer is less than 10 inches thick. In a few areas the silty material is less than 28 inches thick. In some places glacial till is within a depth of 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Lafayette soils and the very poorly drained Mahalasville soils that have a gravelly substratum. These soils are in slight depressions. Also included are the well drained Waupecan soils in the slightly higher areas. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Waupecan soil. Permeability is moderate in the upper part of the solum, moderately rapid in the lower part of the solum, and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate. The water table is at a depth of 3 to 6 feet in winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This soil is well suited to corn, soybeans, and small grain. Crusting is a concern. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as orchardgrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

The shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings. In addition, the wetness is a moderate limitation on sites for buildings with basements. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps to prevent the structural damage caused by shrinking and swelling of the soil. Installing subsurface drains helps to lower the water table. Because of low strength and the potential for frost action, the soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

The land capability classification is I. No woodland ordination symbol is assigned.

WmA—Waynetown silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on stream terraces and outwash plains. It is deep or very deep over gravelly coarse sand. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil is about 43 inches thick. It is dark yellowish brown, mottled, firm silty clay loam in the upper part; grayish brown, mottled, firm clay loam in the next part; and dark gray and dark grayish brown, mottled, firm gravelly sandy clay loam and friable gravelly sandy loam in the lower part. The underlying material to a depth of 60 inches or more is grayish brown, mottled gravelly coarse sand. In a few small areas the silty material is less than 20 inches thick. In some places glacial till is within a depth of 60 inches. In other places the surface layer is darker.

Included with this soil in mapping are small areas of the well drained Kalamazoo and moderately well drained Thackery soils on slight rises and in the more sloping areas. Also included, in depressions, are small areas of the very poorly drained Mahalasville soils that have a gravelly substratum. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Waynetown soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 1 to 3 feet in winter and spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a

system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness is a severe limitation if this soil is used as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of low strength and the potential for frost action, this soil is severely limited as a site for local roads and streets. Strengthening the base material for roads or replacing it with a more suitable material improves the ability of the soil to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

WtA—Wea silt loam, occasionally flooded. This nearly level, very deep, well drained soil is on flood plains. It is subject to occasional flooding for brief or long periods from late fall through spring. Individual areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is very dark gray silt loam about 10 inches thick. The subsurface layer is very dark gray, friable silt loam about 15 inches thick. The subsoil is about 39 inches thick. It is dark brown, firm clay loam and gravelly sandy clay loam in the upper part and dark brown and dark yellowish brown, friable gravelly sandy loam in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown gravelly sand. In places the subsoil has less clay. In a few small areas, the soil is calcareous throughout. In some places the surface layer is sandy loam.

Included with this soil in mapping are the well drained Allison and Battleground soils at the slightly lower elevations. These soils have less sand in the subsoil than the Wea soil. Also included are the somewhat excessively drained Ouiatenon soils that have a sandy substratum. Ouiatenon soils are in the slightly lower lying areas adjacent to stream channels. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Wea soil. Permeability is moderate in the solum and very rapid in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderate.

Most areas of this soil are used for cultivated crops. Some areas are used for woodland, hay, or pasture.

This soil is well suited to corn and soybeans, but damage from floodwaters can be expected. Flooding is the major hazard. Crusting is also a concern. Levees or dikes help to control flooding, but they are extremely expensive if properly constructed. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to control scouring by floodwater, help to prevent crusting, and help to maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to spring moldboard, spring chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture, but prolonged flooding from late fall through spring can damage these crops. Levees and dikes help to control flooding. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the flooding, this soil is generally unsuited to use as a site for dwellings and is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by flooding.

The land capability classification is IIw. No woodland ordination symbol is assigned.

WuA—Whitaker loam, till substratum, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on till plains. It is deep over compact glacial till. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is brown loam about 10 inches thick. The subsoil is about 48 inches thick. It is

brown and grayish brown, mottled, firm loam and clay loam in the upper part; gray, mottled, firm sandy clay loam in the next part; and grayish brown, mottled, very friable loamy sand in the lower part. The underlying material to a depth of 70 inches or more is yellowish brown, mottled loam. In places the surface layer is darker. In a few small areas the surface layer is sandy loam. In a few places the underlying compact glacial till is at a depth of less than 40 inches.

Included with this soil in mapping are moderately well drained soils on slight rises and in the more sloping areas along drainageways. Also included are small areas of the very poorly drained Treaty and Mahalasville soils in depressions and drainageways. Included soils make up about 15 percent of the unit.

The available water capacity is high in the Whitaker soil. Permeability is moderate in the solum and slow in the underlying material. Surface runoff is slow. The content of organic matter in the surface layer is moderately low. The water table is at a depth of 1 to 3 feet in winter and spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few small areas are used as woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness is a major limitation. Crusting is also a concern. Subsurface drains can be used to remove excess water if adequate outlets are available. Using a system of conservation tillage that leaves a protective cover of crop residue on the surface and planting cover crops help to prevent crusting and maintain or improve tilth, infiltration, aeration, and the content of organic matter. This soil is well suited to moldboard, fall chisel, no-till, and ridge-till tillage systems.

This soil is well suited to grasses and legumes, such as reed canarygrass and ladino clover, for hay and pasture. Wetness is a limitation. Subsurface drains can be used to remove excess water if adequate outlets are available. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Overgrazing or grazing when the soil is too wet can cause surface compaction and poor tilth and can reduce plant densities. Proper stocking rates, rotation grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Competing vegetation can be controlled by spraying, cutting, or girdling. Excluding livestock, harvesting mature trees, and saving desired seed trees are additional management practices.

The wetness is a severe limitation if this soil is used as a site for dwellings. Installing subsurface drains helps to lower the water table. Constructing buildings on raised, well compacted fill material also helps to overcome the wetness. Because of the potential for frost action, the soil is severely limited as a site for local roads and streets. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent frost damage.

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

Prime Farmland

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

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

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

About 264,000 acres in the survey area, or nearly 82 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county. Nearly all of the prime farmland is used for corn or soybeans.

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

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

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify as prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this soil survey is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this survey are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Crops and Pasture

William Martin, district conservationist, Natural Resources Conservation Service, helped prepare this section.

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

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

In 1982, a total of 229,079 acres in Tippecanoe County was used as cropland (U.S. Department of Commerce, 1983). Of this acreage, 199,596 acres was used for row crops, mainly corn and soybeans; 10,375 acres was used for wheat or oats; and 6,560 acres was used for hay. About 3,632 acres was used as permanent pasture, and 16,503 acres was woodland.

The acreage used for crops and pasture has been decreasing as more land is developed for urban uses. An estimated 24,000 acres was urban land in 1984.

The soils and climate of the survey area are well suited to most of the crops that are commonly grown in the county and to some specialty crops, such as strawberries, sweet corn, and melons, which are not commonly grown.

Well drained soils that warm up early in the spring are well suited to many vegetables and fruit crops. Examples are Billett and Kalamazoo soils that have slopes of less than 6 percent. Crops can generally be

planted and harvested earlier on these soils than on the other soils in the county.

Most of the well drained soils are suitable for orchard and nursery plants. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

The latest information about crops can be obtained from the local offices of the Cooperative Extension Service or the Natural Resources Conservation Service.

The main concerns in managing the cropland and pasture in Tippecanoe County are drainage, water erosion, soil blowing, fertility, and tilth.

Drainage is the major concern on about 70 percent of the cropland and pasture in the county. The poorly drained and very poorly drained soils, such as Treaty, Drummer, and Mahalasville soils, generally have been adequately drained for agricultural production (fig. 11). A few areas of these soils, however, cannot be economically drained. These are depressional areas where drainage ditches would have to be deep and extended for great distances. An artificial drainage system is needed in areas of the somewhat poorly drained Crosby, Fincastle, Starks, Toronto, and Millbrook soils for optimum crop production.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of a surface drainage system and tile drainage generally is needed if the very poorly drained soils are used for the intensive production of row crops. The drains should be more closely spaced in areas of slowly permeable soils, such as Crosby soils, than in areas of more permeable soils, such as Drummer and Sleeth soils.

Erosion is the major concern on about 20 percent of the cropland and pasture in Tippecanoe County. It is a hazard in areas where the slope is more than 2 percent. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that are only moderately deep to glacial till, such as Marker, Miami, and Octagon soils. It is also damaging in areas where the soils have a layer in or below the subsoil that limits the depth of the root zone. An example is the bedrock underlying High Gap Variant and Shadeland soils. Erosion reduces productivity even more on soils that tend to be droughty, such as Kosciusko soils. If the subsoil is clayey and most of the topsoil has been lost, preparing a good seedbed and tilling are difficult. Erosion also results in the sedimentation of streams. Nutrients and farm-applied chemicals may adhere to the eroding soil particles and be washed from the field along with the runoff. Controlling erosion minimizes this pollution and improves the quality of water for municipal and recreational uses and for fish and wildlife.

Erosion-control measures provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the surface for extended periods can hold soil losses to an amount that will not reduce the productive capacity of the soils. On livestock farms, where part of the acreage is used for pasture and hay, including legumes and grasses in the cropping sequence helps to control erosion in sloping areas. The grasses and legumes also provide nitrogen and improve tilth for the following crop.

The slopes are so short and irregular on much of the sloping soils in the county that contour farming and terraces are generally not practical. On these soils, a system of conservation tillage or a cropping system that provides a substantial cover of vegetation is needed to control erosion. Conservation tillage leaves crop residue on the surface, increases the rate of water infiltration, and helps to control runoff and erosion.

No-till farming of both corn and soybeans is being used increasingly by the farmers in the county. It is the single most effective erosion-control practice. This method of tillage is suitable for the moderately coarse textured and coarse textured, more sloping soils that warm up early in the spring. These soils are generally the most susceptible to erosion and thus need the most protection. No-till also works well on most of the soils if the new crop is planted into soybean stubble because the light cover of residue from soybeans allows the soils to warm up relatively early in the spring.

Ridge-till is another important type of conservation tillage system. It has great potential for increased use in Tippecanoe County. Studies have indicated that ridge-till is currently the most profitable system of farming. It is well adapted to nearly all of the soils in the county. Favorable factors include low power requirements, a need for lower amounts of chemical herbicides, savings of time and fuel, improvement of tilth, effective erosion control, and greater net profits. The cost of equipment changes may be a concern when this practice is adopted.

Chiseling is the most widely used method of conservation tillage in Tippecanoe County. It has high power requirements and results in major soil disturbance, but its similarity to plowing may account for its popularity. Unless the chiseling is done across the slope and crop residue is left on at least 30 percent of the surface, the effectiveness of this system in controlling erosion may be reduced.

More information about conservation tillage systems is provided in table 6.

Parallel tile outlet (PTO) terraces reduce the length of slopes and thus are effective in controlling sheet, rill,

Figure 11.—Harvesting corn in an area of Drummer soils. These soils have been adequately drained for the production of crops.

and gully erosion. They are most effective in areas of deep, well drained soils that are highly susceptible to erosion.

Water- and sediment-control basins can be used in much the same manner as PTO terraces. They consist of low earthfill dams across drainageways with tile outlets. They are installed singly or in series, depending on the site. They are set across the drainageways in a direction parallel to the farming rows and will accommodate straight-row farming with large equipment. The benefits of terraces and water- and sediment-control basins include minimizing the loss of soil and the associated loss of fertilizer elements; reducing the extent of sedimentation, which damages crops, watercourses, and offsite areas; and reducing the need for grassed waterways, which take land out of production of row crops. Soils that have bedrock within a depth of 40 inches or that have a clayey subsoil are less suited to terraces and diversions than other soils.

Grassed waterways are needed in many sloping areas, such as some areas of Miami and Octagon soils, and in many places where a large watershed drains across areas of Toronto-Millbrook complex, 0 to 2 percent slopes, and areas of Drummer soils. A subsurface drainage system generally is needed if the waterways are established in areas of these map units. Also, tile drainage is needed in the waterways established in many seepy areas of Toronto-Octagon complex, 2 to 6 percent slopes, eroded, along drainageways.

Because of the large number of open ditches in the county, many grade-stabilization structures are needed. These structures help to control erosion in areas where surface water drains into an open ditch. They may also be needed in some open ditches where, because of the grade, the water moves so rapidly that erosion is a

problem on the sides and bottom of the channels.

Soil blowing is a hazard on soils in Tippecanoe County that are plowed in the fall. Soil blowing can be controlled by maintaining a cover of plants or a surface mulch or by maintaining a rough surface by using proper tillage methods. Windbreaks of adapted trees and shrubs also are effective in controlling soil blowing.

Information about the erosion-control and drainage measures suitable for each kind of soil is available at the local office of the Natural Resources Conservation Service.

Soil fertility is affected by the content of plant nutrients and by reaction. On all of the soils in the county, plants respond well to nitrate, phosphate, and potash fertilizers. On most soils, applications of ground limestone are needed to raise the pH to a level that is optimum for the growth of crops. On all soils, the amount of lime and fertilizer to be applied should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help to determine the kind and amount of fertilizer and lime needed.

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

Many of the soils in the county have a surface layer that is predominantly silt loam and that has a moderately low to high content of organic matter. The structure of these soils is moderate or weak, and intense rainfall can cause crusting of the surface. The hard crust reduces the infiltration rate, thereby increasing the runoff rate. These soils tend to dry out slowly and can easily become compacted. Regular additions of crop residue, manure, and other organic material improve soil structure and help to prevent crusting.

Soils on the prairie, which were once mainly grassland, and soils in prairie-intergrade areas, which were once grassland with scattered trees, generally have a moderate or high content of organic matter, are relatively dark, and have better natural tilth. These soils warm up more quickly in the spring than some other soils and are less likely to form a crust or to become compacted.

Tilth is a problem in areas where a clayey subsoil is exposed as a result of severe erosion. Conservation practices are needed in these areas to control erosion and improve tilth. Regular additions of crop residue, manure, and other organic material improve soil structure and tilth in these areas.

Tilth is also a problem in areas of dark soils in depressions, such as Mahalasville, Treaty, Milford, and Drummer soils. These soils often stay wet until late in the spring. If plowed when wet, they tend to become very cloddy when they dry. As a result of this cloddiness, preparing a seedbed is difficult. A subsurface drainage system commonly improves tilth in these areas. Using a ridge-till system for several consecutive years is also very effective in improving tilth in these areas.

Specialty crops grown in Tippecanoe County include seed corn and popcorn. The latest information about growing specialty crops is available at the local offices of the Cooperative Extension Service and the Natural Resources Conservation Service.

Tillage Adaptability

By William P. Martin, district conservationist, Natural Resources Conservation Service, and Jerry V. Mannering, extension agronomist and professor of agronomy, Purdue University.

Table 6 rates the adaptability of several kinds of conservation tillage for the soils in the county. This table is a county-level, partial adaptation of the Purdue University publication AY-210 (Galloway and others, 1977).

Conservation tillage is a form of noninversion tillage that retains a protective cover of crop residue or mulch on the surface throughout the year. Leaving at least 30 percent of the surface covered by residue after planting is necessary to control water erosion. In areas where soil blowing is the primary concern, at least 1,000 pounds of flat small-grain residue equivalent should be left on the surface. Chiseling, no-till, ridge-till, and other types of noninversion tillage are examples of conservation tillage systems.

Fall moldboard plowing generally includes chopping or discing stalks before plowing. Some farmers purposely omit this operation and sometimes remove cover boards, which results in a slight surface residue cover after plowing. In the spring, two or more shallow tillage operations with a disc, field cultivator, or harrow prepare the seedbed. In some cases, the final tillage may be combined with planting. This practice essentially leaves the soil bare throughout the winter. It is suited to nearly level, wet, dark soils that are not subject to soil blowing. It increases the vulnerability of moderately coarse textured and coarse textured soils or of soils that are more sloping to soil blowing or water erosion.

In *spring moldboard plowing,* secondary tillage is similar to that for fall plowing but additional operations may be needed to break the clods sufficiently. A cultimulcher or rotary tiller is often used for final fitting. Erosion concerns are similar to those for fall plowing.

A *fall chisel* operation generally employs chisel points 2 inches wide and spaced 12 to 15 inches apart for tilling to a depth of 8 to 10 inches. Stalks are usually

chopped or disced before chiseling unless coulters are mounted in front of the chisel plow. Spring seedbed preparation should be minimal and limited to the amount necessary to smooth out the surface for planting. The soil surface remains cloddy over the winter, and 30 to 50 percent is covered with residue. After planting, 10 to 30 percent of the surface may remain covered with residue.

In this table, the term "chisel" is used in lieu of "mulch-till" because of its predominant use in the county. Although a disc may be used instead of a chisel, chiseling is by far the most commonly used form of mulch-till used in the county. Mulch-till, however, is the terminology preferred by the Conservation Technology Information Center (CTIC). Also, strip-till is not included in the table because the CTIC definition of this system includes in-row tillage at planting time, which is not practiced in Tippecanoe County.

Spring chisel tillage on moderately well drained and well drained soils is the same as for fall chisel tillage. On poorly drained and somewhat poorly drained soils, however, spring chiseling is commonly limited to a shallow depth because of the wetness. Secondary tillage should be limited to the amount necessary to smooth out the seedbed for planting.

In a *slot-plant* no-till system, stalks of the previous corn crop can either be left intact or chopped and left on the surface of the soil. At planting, a strip 1 to 3 inches wide is prepared in the row. The most popular tools for preparing the strips are nonpowered, fluted or straight coulters in front of the planter units. Disc openers and ribbed press wheels are usually necessary to firm the seed in the tilled slot. Because all residue remains on the surface, the cover may vary from 60 to 90 percent, depending on the amount of residue from the previous crop, the method of harvesting, and the width of the tilled strip. Weed control is accomplished primarily with herbicides. For solid-seeding no-till soybeans, special no-till grain drills are used.

In a no-till system that involves *residue-cleared rows,* the previous crop residue, generally corn, is cleared from a narrow 8-inch band centered on the planting row. The crop is then planted in the slot as in the slot-plant system. At planting time the residue is cleared from the row with a row cleaner. This step promotes earlier warming of the soil and results in more vigorous early-season growth of the young seedlings. Because residue is cleared from a band over the row, the cover may vary from 50 to 80 percent, depending on the amount of residue from the previous crop, the method of harvesting, and the width of the cleared planting row. This adaptation of no-till farming is still being investigated, and possible advantages are not yet supported by hard research data. Commercial no-till corn planters with row cleaners capable of clearing a residue-free area are available. Innovative farmers are adapting other existing equipment for this use.

Ridge-till, also known as ridge-plant or till-plant, is a once-over operation performed in the spring. Seeds are planted in ridges made the previous year, usually at cultivating time (fig. 12). The soil is undisturbed prior to planting. Wide sweeps or row-cleaning discs on or ahead of the planter remove the top 1 to 3 inches of the ridge and push clods and corn stubble in between the rows. Seed is dropped and firmed into moist soil behind the sweeps or discs by packer wheels. With some planters, small covering discs then move loose soil over the seed. Ridges 4 to more than 6 inches high, depending on row width, can be made in the row at cultivation, commonly with a cultivator made especially for this purpose with large sweeps and disc-hillers. Weed control is accomplished by a combination of herbicides and cultivation.

If the ridges are formed at cultivation time, all residue remains on the surface throughout the winter. About 20 to 35 percent remains after planting, and the soil clods and corn residue are concentrated between rows. Therefore, the row area may form an erosive water channel if seeds are planted up and down the slope. Most experienced ridge-till planters have found that this problem is not significant after 3 to 5 years of soil reconditioning resulting from the continual incorporation of crop residue into the surface layer. Ridge-till is a much more effective conservation practice if used after a corn crop rather than after a soybean crop. Aerially seeding a cover crop of rye or wheat around the 1st of September in soybeans can reduce soil losses in ridged bean stubble, but chemical vegetative control will be necessary in the spring.

The tillage system is rated *good* if it is highly adapted by all applicable standards or if it is well adapted but limitations may occur at low frequency over a small part of an area. For example, slower warming may delay plant growth in the spring or moderate erosion may occur as a result of severe storms. The limitations can be overcome with good management. This rating coincides with ratings 1 and 2 in Purdue University publication AY-210 (Galloway and others, 1977).

The tillage system is rated *fair* if limitations similar to those described above occur more frequently or over a wider area. Management is more difficult, but the limitations can be overcome. This rating coincides with rating 3 in Purdue University publication AY-210 (Galloway and others, 1977).

The tillage system is rated *poor* if limitations occur more frequently or over a wider area than those where the system is rated fair. The system may also be unadaptable if limitations occur very frequently or over

Figure 12.—Ridge-till corn and soybeans planted in strips in an area of Toronto-Millbrook complex, 0 to 2 percent slopes.

an entire area. This rating coincides with ratings 4 and 5 in Purdue University publication AY-210 (Galloway and others, 1977).

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 7. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity

of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

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

Land Capability Classification

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

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

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The acreage of soils in each capability class and subclass is shown in table 8. The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

David F. Berna, forester, Natural Resources Conservation Service, helped prepare this section.

Table 9 can be used by woodland owners or forest managers in planning the use of soils for wood crops (fig. 13). Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *N*, snowpack. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one

Figure 13.—A walnut plantation in an area of Bowes silt loam, 0 to 2 percent slopes.

limitation, the priority is as follows: R, X, W, T, D, C, S, F, and N.

In table 9, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that

erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

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

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

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

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *productivity class*. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

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

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

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

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

James D. McCall, biologist, Natural Resources Conservation Service, helped prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or

kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, soybeans, oats, and sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, orchardgrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, ragweed, docks, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, wild cherry, black walnut, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, elderberry, chokecherry, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, dove, woodcock, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, kingfishers, muskrat, mink, and beaver.

Not rated in the table but of prime importance for birds and mammals is *edge habitat*. This habitat occurs where one type of major land use cover ends and another begins. Species ranging from the smallest songbirds to white-tailed deer use edge habitat. Most of the plants and animals that inhabit openland areas and woodland are also in areas of edge habitat. Desirable edge habitats are consistently used by about 10 times more wildlife than are the center of large fields or either woodland or cropland. A good example of edge habitat is an area where the outside edge of a dense woodland parallels the outside edge of a no-till field of corn.

Engineering

Jeff Healy, state conservation engineer, Natural Resources Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water

management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or to a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding or ponding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, ponding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, ponding, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface

and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding or ponding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, and the available water capacity in the upper 40 inches affect plant growth. Flooding or ponding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface drains or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding or ponding affect absorption of the effluent. Large stones and bedrock interfere with installation. Most of the soils in Tippecanoe County have either moderate or severe limitations affecting septic tank absorption fields. Some of the limitations can be overcome by using alternative systems.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravelly sand or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, ponding or flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater or ponded water overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in

successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of groundwater pollution. Ease of excavation and revegetation should be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding or ponding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing (fig. 14). They are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight,

Figure 14.—A sand and gravel pit in an area of Carmi loam, 0 to 2 percent slopes.

large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or

Figure 15.—A grassed waterway in an area of Drummer soils.

respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table and permeability of the aquifer. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity (fig. 15). Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at (800) 457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

Nondiscrimination Statement

Nondiscrimination Policy

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the basis of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, whether all or part of an individual's income is derived from any public assistance program, or protected genetic information. The Department prohibits discrimination in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases apply to all programs and/or employment activities.)

To File an Employment Complaint

If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081.wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for

program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).