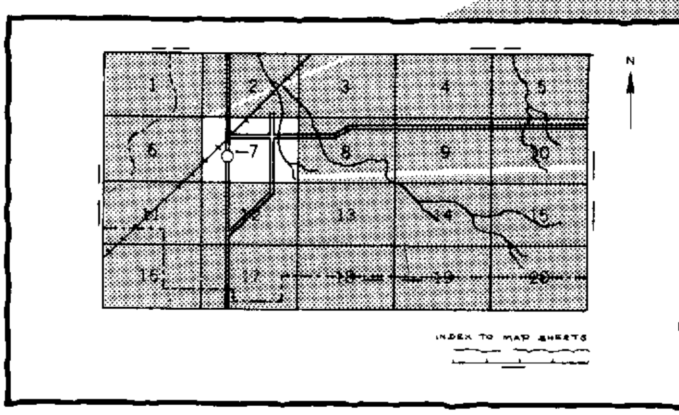
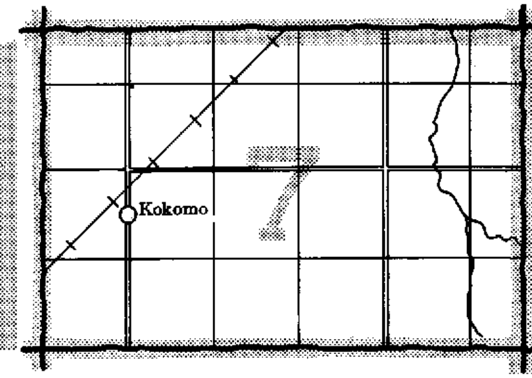
SOIL SURVEY OF
Vermillion County, Indiana

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

HOW TO USE

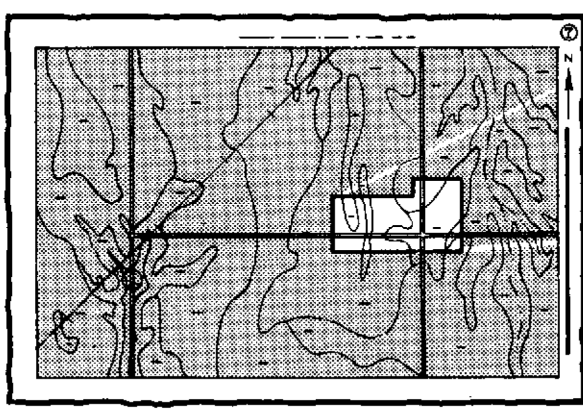
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

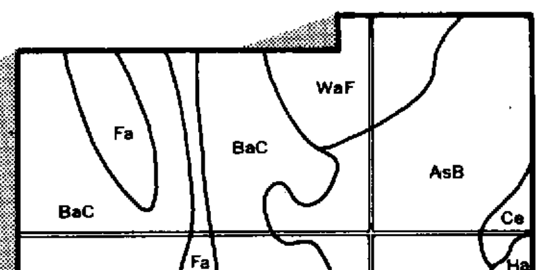




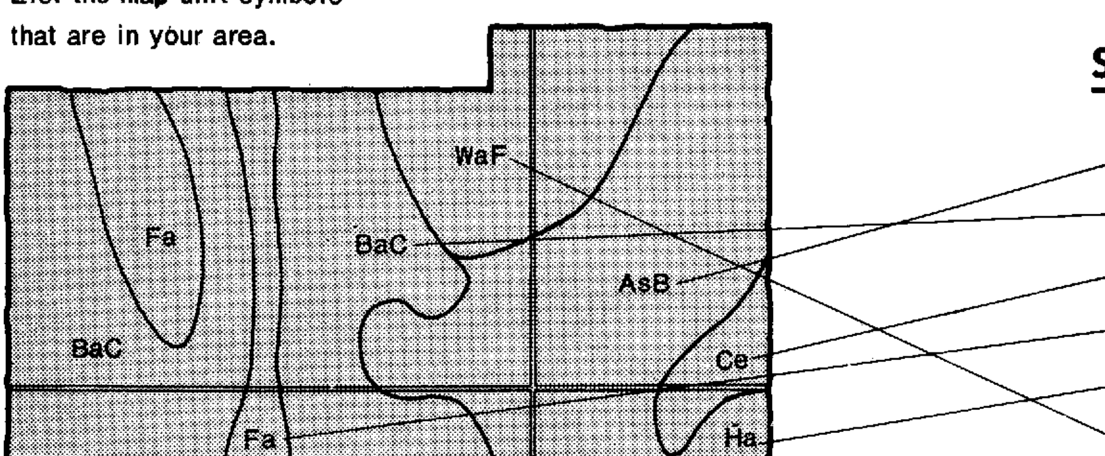
2. Note the number of the map sheet and turn to that sheet.

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





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

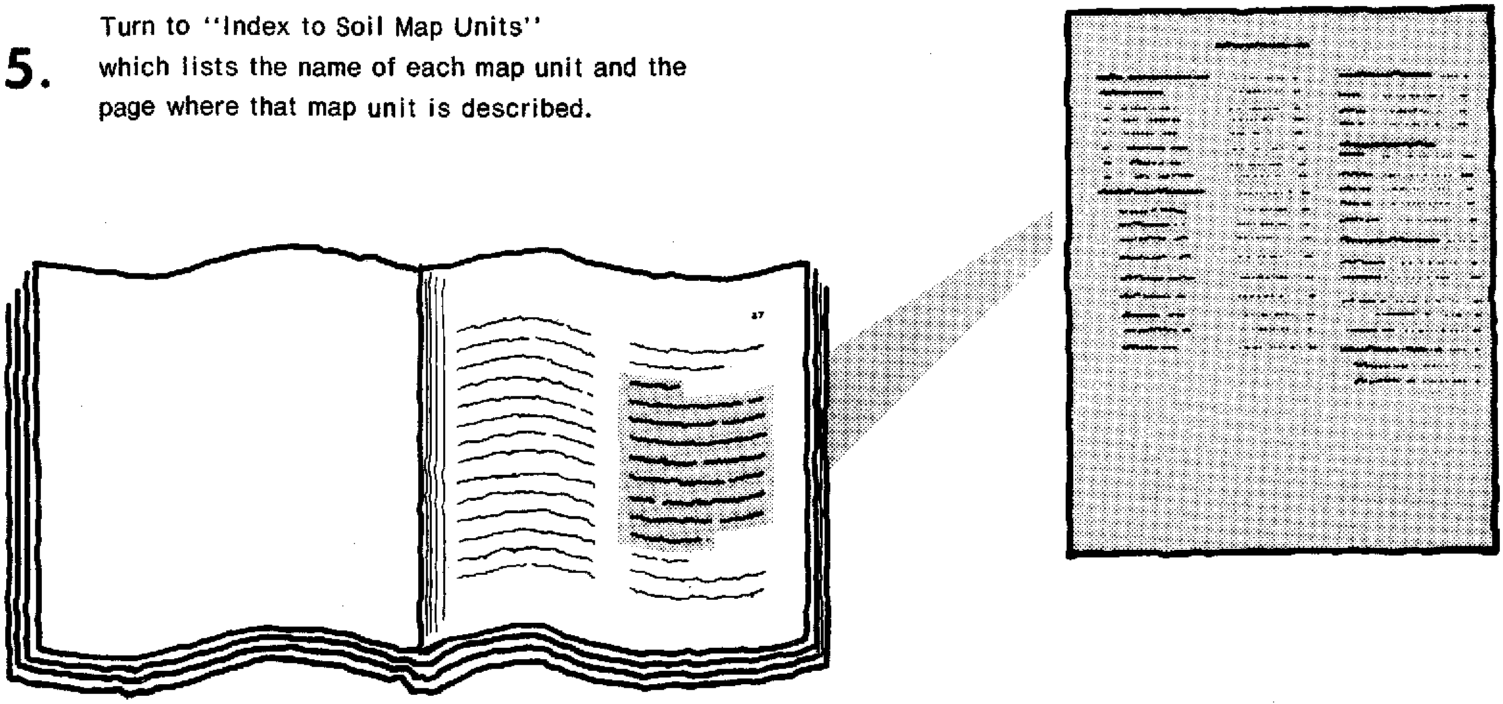


Symbols

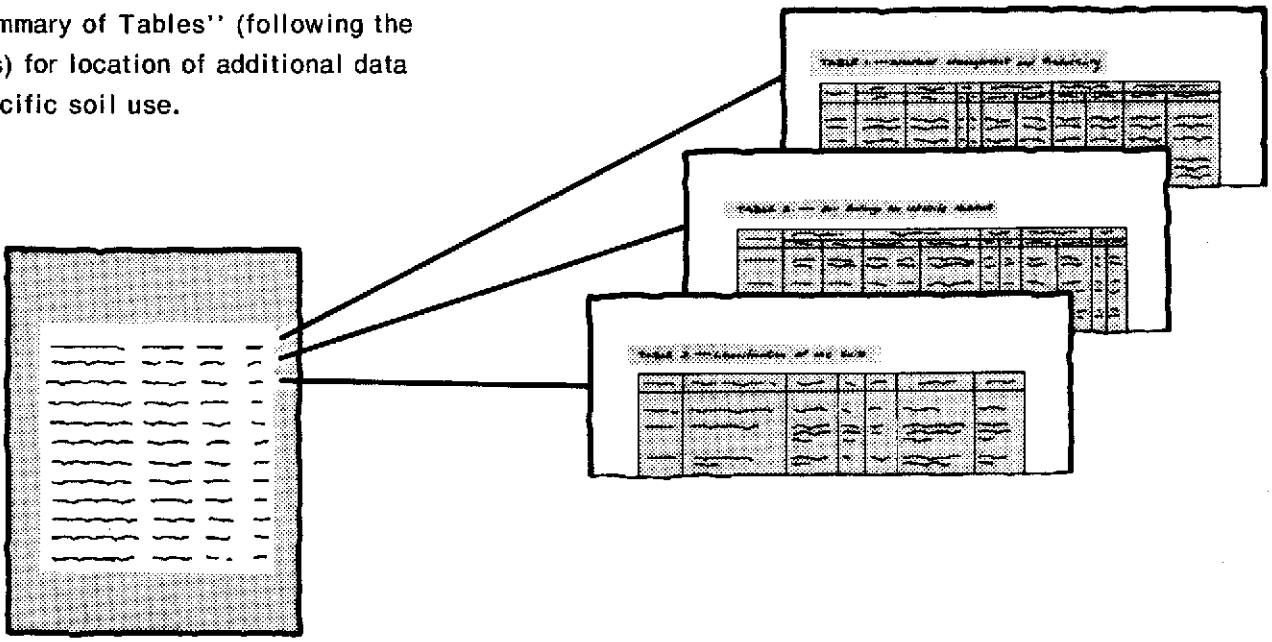
AsB
BaC
Ce
Fa
Ha
WaF

THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1972-75. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Vermillion County Soil and Water Conservation District. Financial assistance was made available by the County Commissioners and the County Council.

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Issued September 1978

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Foreword

The Soil Survey of Vermillion County, Indiana, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

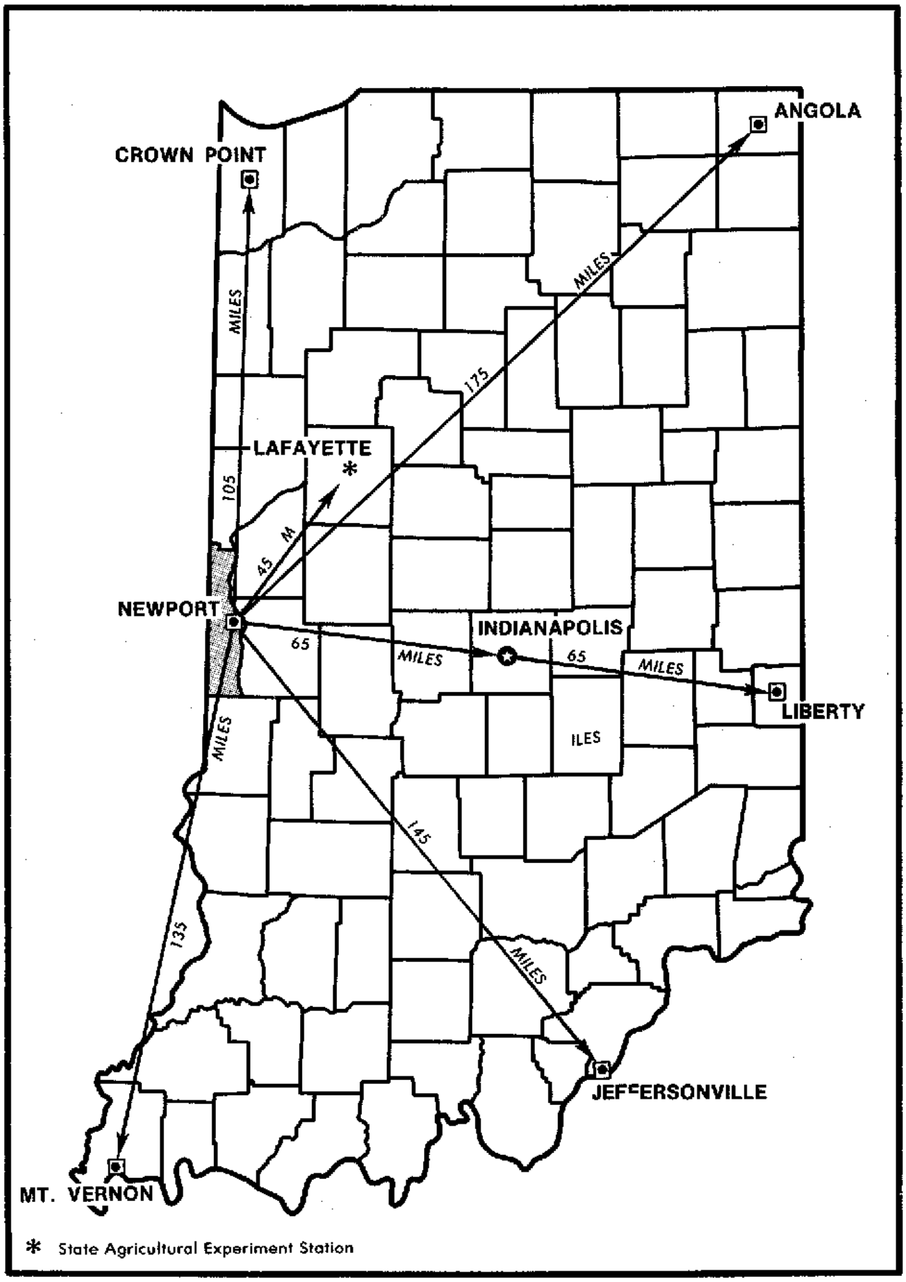
Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption 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 kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Buell M. Ferguson

Buell M. Ferguson
State Conservationist
Soil Conservation Service



Location of Vermillion County in Indiana.

SOIL SURVEY OF VERMILLION COUNTY, INDIANA

By John M. Robbins, Jr., and Mac H. Robards, Soil Conservation Service

Fieldwork by John M. Robbins, Jr., Mac H. Robards, and Travis Neely, Soil Conservation Service

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

VERMILLION COUNTY is on the western edge of Indiana (see map on facing page). It is long and narrow, 5 to 9 miles wide, and about 38 miles from north to south. The Wabash River is the eastern boundary. The county has an area of 263 square miles, or 168,320 acres. Newport is the county seat.

Farming is the leading occupation, and growing cash grain crops and raising livestock are the major types of farming. The major livestock enterprises are feeding hogs and beef cattle.

Some of the areas around Clinton and between Newport and Cayuga are under urban development. This soil survey emphasizes the use of soils for farming but also discusses nonfarm uses.

General nature of the county

General features that affect soil use in Vermillion County are briefly described in the following paragraphs.

Relief

The highest point in Vermillion County is about 690 feet above sea level. It is near Indiana State Road 234 in Eugene Township, about three-fourths of a mile east of the Illinois State line and 3 miles west of Cayuga. The lowest elevation is about 470 feet above sea level in several areas along the Wabash River between U.S. Highway 36 and the southern boundary.

Vermillion County is generally a smooth plain dissected by a few shallow but broad stream valleys. The stream valleys consist of broad outwash plains and terraces and low-lying bottom land. Strongly sloping to very steep areas border the valleys of the major streams, where considerable dissection has occurred.

The Wabash River flows southward along the eastern edge of the county. The tributaries of the Wabash River generally flow southeastward. Spring Creek and the Big Vermillion River drain the northern part of the county. The Little Vermillion River drains the central part. Little Raccoon, Norton, Feather, and Brouilletts Creeks drain the southern part.

Water

The main source of water in Vermillion County is wells. Most important are the drilled wells in terraces and in the bottom land along the Wabash River.

The chief sources of ground water are rocks of the Early and Middle Pennsylvanian age; consolidated glacial deposits of till and sand and gravel overlying the consolidated rocks; and sand and gravel covered by or interbedded with glacial till (*6*).

Climate

Prepared by LAWRENCE A. SCHAAL, State climatologist, Department of Agronomy, Purdue University.

Vermillion County has a continental climate. The climate is similar to that in other areas just south of the county along the Wabash River rather than to the climate in the higher areas to the east.

Rainfall is usually adequate during the growing season for diversified farming. In midsummer, however, evaporation from soils and crops exceeds rainfall for brief periods and adversely affects lawns, pastures, and crops.

Weather changes every few days come from the passing weather fronts and associated centers of low and high air pressure. In general, a high brings lower temperatures, lower humidity, and sunny days. An approaching low brings increasing temperatures, increasing southerly winds, higher humidity, and rain or showers. Weather changes are greatest in winter and spring and least late in summer and early in fall.

The average annual precipitation is evenly distributed throughout the year. Spring rains usually insure good soil moisture supplies into the summer. Sometimes, wet fields in spring delay planting.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Rockville for the period 1940 to 1973. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring.

In winter the average temperature is 31 degrees F, and the average daily low is 22 degrees. The lowest temperature on record, which occurred at Rockville on February 13, 1905, is minus 22 degrees. In summer the average temperature is 74 degrees, and the average daily high is 85 degrees. The highest recorded temperature, which occurred at Rockville on July 14, 1936, is 109 degrees.

The total annual precipitation is 41.1 inches. Of this total 23.5 inches, or 57 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19.3 inches. The heaviest 1-day rainfall during the period of record was 8.74 inches at Rockville on June 28, 1957. Thunderstorms occur on about 45 days each year, and 8 of these days are in June.

Average seasonal snowfall is 24 inches. The average monthly snowfall during the period December through March is 5.1 inches. On the average, 25 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity at noon is less than 58 percent in spring and about 69 percent in winter. Humidity is higher at night, and the average at 7 a.m. is about 83 percent. The percentage of possible sunshine is 71 in August and 39 in December. The prevailing wind is from the southwest. Average windspeed is 10 miles per hour.

Transportation facilities

There are about 6 miles of interstate highway in the northern part of Vermillion County. Another 95 miles of other Federal and State highways cross the county in all directions. Also, thoroughfares, primary roads, and collector roads total 479 miles. Most of the roads are paved. Two small airports serve small, privately owned planes. Five main railroad lines cross the county.

Manufacturing and business services

A manufacturing plant for dairy products, a meat processing plant, and several farm machinery, fertilizer, and seed dealerships are located in the county.

Trends in population and land use

Vermillion County has a population of about 16,793 and a population density of 64 per square mile. The population decreased by 5 percent between 1960 and 1970 but is expected to increase by 1980.

During the period 1958 to 1967, the area of urban land increased by 4 percent. Cropland decreased by 1 percent, grassland decreased by 26 percent, and forest land increased by 59 percent. About 89 percent of the county remained in farmland. The acreage of urban land is expected to slowly increase at the expense of farmland.

How this survey was made

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

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

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

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land-use planning" and "Soil maps for detailed planning."

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

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land-use planning

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

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Map unit descriptions

1. Xenia-Russell-Fincastle

Deep, nearly level to moderately sloping, well drained, moderately well drained, and somewhat poorly drained soils formed in loess and loamy glacial till

Scattered areas of these nearly level to moderately sloping soils are throughout the county. They are on uplands paralleling the minor streams.

This map unit occupies about 25 percent of the county. It is about 30 percent Xenia soils, 23 percent Russell soils, 15 percent Fincastle soils, and 32 percent soils of minor extent (fig. 1).

The moderately well drained Xenia soils are in the lower lying areas near drainageways. The well drained Russell soils are gently sloping and moderately sloping. The somewhat poorly drained Fincastle soils are on broad flats. All of the soils have a silt loam surface layer. Fincastle soils have a seasonal high water table.

Of minor extent in this map unit are the well drained Alford, Hennepin, and Miami soils, generally on the steeper landforms; Reesville soils on broad flats; and Rush soils on outwash terraces.

This map unit is used mainly for cultivated crops, small grain, and forage crops. Most of the acreage has been cleared, and some areas have been drained. Slope and wetness are the main limitations for farming and for most other uses. Wetness is common on the Fincastle soils in winter and spring.

This map unit has fair potential for cultivated crops, small grain, and forage crops. Drainage is needed in the flatter areas, and erosion control is needed in the steeper areas. The potential for urban uses is only fair because the Fincastle and Xenia soils are wet. The potential for woodland is good.

2. Genesee-Armiesburg

Deep, nearly level, well drained soils formed in loamy alluvial deposits

Scattered areas of these nearly level soils are throughout the county. They are on the bottom land along the Wabash River and the major streams.

This map unit occupies about 15 percent of the county. It is about 45 percent Genesee soils, 16 percent Armiesburg soils, and 39 percent soils of minor extent.

Generally, the well drained Genesee soils are slightly higher in elevation than the Armiesburg soils and are adjacent to the streams. The well drained and moderately well drained Armiesburg soils are in the lower lying, flatter areas away from the streams. Genesee soils have a silt loam surface layer. Armiesburg soils have a silty clay loam surface layer.

Of minor extent in this map unit are the well drained Stonelick soils near the streams, the moderately well drained Eel soils in broad swales, the somewhat poorly drained Shoals soils and very poorly drained Sloan soils in depressional areas on the flood plains, and small areas of Miami, Hennepin, Gosport, and Fox soils on the steeper breaks adjacent to the bottom land.

This map unit is used mainly for cultivated crops, small grain, and forage crops. Flooding is the main hazard for farming and for most other uses. It is common in winter and spring.

If protected against flooding, this map unit has good potential for cultivated crops, small grain, and forage crops. Flooding is such a severe hazard and is so difficult to overcome that the potential for residential and other urban uses is poor.

3. Reesville-Ragsdale-Fincastle

Deep, nearly level, somewhat poorly drained and very poorly drained soils formed in loess and loamy glacial till

Scattered areas of these nearly level soils are throughout the county. These flat and depressional areas are on uplands.

This map unit occupies about 20 percent of the county. It is about 35 percent Reesville soils, 35 percent Ragsdale soils, 15 percent Fincastle soils, and 15 percent soils of minor extent (fig. 2).

The somewhat poorly drained Reesville and Fincastle soils are generally on broad swells at a slightly higher elevation than the very poorly drained Ragsdale soils, which are mainly in slight depressions. All of the soils have a seasonal high water table and a silt loam surface layer.

Of minor extent in this map unit are the well drained Russell soils on the steeper breaks near drainageways, the moderately well drained Xenia soils on the highest lying swells, and the somewhat poorly drained Starks soils on swells.

This map unit is used mainly for cultivated crops, small grain, and forage. A few undrained areas are swampy. Wetness is the main limitation for farming and for most other uses. Also, flooding and ponding are common in winter and spring.

If adequately drained, this map unit has good potential for cultivated crops, small grain, and forage crops. Wetness is such a severe limitation and is so difficult to overcome that the potential for residential and other urban uses is poor. The potential for development of woodland is fair.

4. Shipshe-Fox-Elston

Deep, nearly level to moderately sloping, well drained soils formed in glacial outwash over stratified very gravelly sand and sand

Scattered areas of these nearly level to moderately sloping soils are throughout the county. They are on terraces that are lower in elevation than the surrounding upland.

This map unit occupies about 15 percent of the county. It is about 24 percent Shipshe soils, 24 percent Fox soils, 15 percent Elston soils, and 37 percent soils of minor extent.

The well drained Shipshe and Fox soils are generally on the higher flats adjacent to bottom land. The well drained, nearly level to gently sloping Elston soils are dominantly on swells away from streams. The Shipshe soils have a loam surface layer. The Fox soils have a surface layer of sandy loam, loam, or clay loam, depending on the slope and the degree of erosion. The Elston soils have a sandy loam surface layer.

Of minor extent in this map unit are the well drained Wea, Ockley, and Martinsville soils on terraces and Genesee and Stonelick soils on the lower lying bottom land.

This map unit is used mainly for cultivated crops, small grain, and forage. Some areas of the steeper soils are wooded. On about 970 acres, the underlying deposits of sand and gravel are used commercially.

This map unit has good potential for small grain, cultivated crops, and forage crops. It also has good potential for residential and other urban uses, but the effluent from septic systems can seep into ground water. The potential for development of woodland is good.

5. Hennepin-Miami

Deep, moderately sloping to very steep, well drained soils formed in loamy glacial till

Scattered areas of these moderately sloping to very steep soils are throughout the county. In long, irregularly shaped areas parallel to the major streams, slopes are short and very steep. They are moderately sloping and strongly sloping in areas separating uplands from terraces or bottom land.

This map unit occupies about 10 percent of the county. It is about 70 percent Hennepin soils, 20 percent Miami soils, and 10 percent soils of minor extent (fig. 3).

The well drained Hennepin soils are steep and very steep. The well drained Miami soils are moderately sloping and strongly sloping. Hennepin soils have a loam surface layer, and Miami soils have a silt loam surface layer.

Of minor extent in this map unit are the well drained High Gap, Rush, and Russell soils on the slightly higher lying rises; the moderately well drained, very steep Gosport soils in the lower lying areas; and the well drained Genesee soils on bottom land.

This map unit is used mainly for trees for wood products. A few areas are used for legumes for forage. Most of the acreage is woodland.

The map unit has good potential for timber for wood products. The slope is such a severe limitation and is so difficult to overcome that the potential for residential and other urban uses is poor. The potential for development of woodland is good.

6. Sable-Flanagan

Deep, nearly level, somewhat poorly drained and very poorly drained soils formed in loess or in loess and the underlying loamy glacial till

Areas of these nearly level soils are in the west-central part of the county. They are on broad, loess-covered uplands.

This map unit occupies about 9 percent of the county. It is about 53 percent Sable soils, 30 percent Flanagan soils, and 17 percent soils of minor extent (fig. 4).

The somewhat poorly drained Flanagan soils generally are slightly higher in elevation than the very poorly drained Sable soils. Flanagan soils have a silt loam surface layer, and Sable soils have a silty clay loam surface layer. Both soils have a seasonal high water table.

Of minor extent in this map unit are the somewhat poorly drained Raub soils, which occupy the same positions as the Flanagan soils; the moderately well drained, nearly level and gently sloping Plano and Proctor soils on the higher lying rises; and the moderately well drained and well drained, gently sloping Dana soils in the lower and higher positions on the landscape.

This map unit is used for cultivated crops, small grain, and forage crops. If adequately drained, it has good potential for those uses. Wetness is such a severe limitation and is so difficult to overcome that the potential for residential and other urban uses is poor. The potential for development of woodland is fair.

7. Sable-Ipava

Deep, nearly level, somewhat poorly drained and very poorly drained soils formed in deep loess over deposits of stratified material

Areas of these nearly level soils are in the northwestern part of the county. They are on broad, loess-covered uplands.

This map unit occupies about 6 percent of the county. It is about 55 percent Sable soils, 35 percent Ipava soils, and 10 percent soils of minor extent (fig. 5).

The somewhat poorly drained Ipava soils generally are slightly higher in elevation than the very poorly drained Sable soils. Ipava soils have a silt loam surface layer, and Sable soils have a silty clay loam surface layer. Both soils have a seasonal high water table.

Of minor extent in this map unit are the moderately well drained Plano, Proctor, and Tama soils on the slightly higher rises and the moderately well drained Eel soils in narrow drainageways.

This map unit is used mainly for cultivated crops and for grasses and legumes for forage. Wetness is the main limitation for farming and most other uses. Also, flooding and ponding are common in winter and spring.

If adequately drained, this map unit has good potential for cultivated crops, small grain, and forage crops. Wetness is such a severe limitation and is so difficult to overcome that the potential for residential and other urban uses is poor. The potential for development of woodland is fair.

Broad land-use considerations

Deciding which soils should be used for urban development is an important issue in the survey area. Each year a small acreage is developed for urban uses, especially in Clinton, Eugene, and Vermillion Townships. The general soil map is helpful in planning the general outline of urban areas; it cannot be used for the selection of sites for specific urban structures. The data about specific soils in this survey can be helpful in planning future land-use patterns.

Areas where the soils are so unfavorable that urban development is not desirable are extensive in the survey area. The Genesee-Armiesburg map unit is on flood plains where flooding is a severe hazard. Extensive drainage is needed on the wet soils in the Reesville-Ragsdale-Fincastle, the Sable-Flanagan, and the Sable-Ipava map units. The Fincastle soils in the Xenia-Russell-Fincastle map unit are severely limited for urban development by wetness. The Hennepin-Miami map unit is severely limited for urban development because the slopes are too steep.

On many sites the Shipshe-Fox-Elston map unit can be developed for urban uses at low cost. All of the soils in this map unit are well suited to urban development.

The Reesville-Ragsdale-Fincastle, Sable-Flanagan, and Sable-Ipava map units have good potential for farming, but they have only fair or poor potential for nonfarm uses because wetness is a severe limitation. This limitation can be overcome by subsurface and surface drainage systems. Many farmers have provided sufficient drainage for farm crops.

Vegetables and other specialty crops are suited to the Shipshe-Fox-Elston map unit. Irrigation may be needed during dry years. These soils warm up earlier in spring than do the heavier, wetter soils. Nurseries are well suited to these well drained soils.

Most soils in the county have good or fair potential for woodland. Commercially valuable trees are less common and generally do not grow so rapidly on the wetter soils in the Reesville-Ragsdale-Fincastle, Sable-Flanagan, and Sable-Ipava map units as they do on other soils.

The Xenia and Russell soils have good potential as sites for parks and extensive recreation areas. Hardwood forests on these soils have esthetic value. Undrained areas of the Reesville-Ragsdale-Fincastle, Sable-Flanagan, and Sable-Ipava map units are good nature study areas. All of the map units provide habitat for many important species of wildlife.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. Dana and Xenia, for example, are the names of two soil series.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Fox sandy loam, 2 to 6 percent slopes, eroded, is one of several phases within the Fox series.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Dumps, mine, is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

AlB2—Alford silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on broad ridgetops, long side slopes, and toe slopes in the uplands. Areas are generally narrow and irregularly shaped. They range from 4 to 20 acres in size and are dominantly about 10 acres.

In a typical profile, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is about 44 inches thick. The upper 6 inches of the subsoil is yellowish brown, friable silt loam; the next 20 inches is yellowish brown, firm silty clay loam; and the lower 18 inches is yellowish brown, friable silt loam. The substratum to a depth of about 72 inches is strong brown silt loam. In places the subsoil is less thick.

Included with this soil in mapping are a few small, slightly depressional areas of Xenia soils. Also included are small areas of soils that have slopes of more than 6 percent. In some small, severely eroded, steeper areas, part of the subsoil has been mixed with the surface soil by plowing and the surface layer is silty clay loam.

Available water capacity is very high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for most uses is good.

This soil is well suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures are needed to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the moderate permeability, seepage, and a severe hazard of erosion during construction adversely affect engineering uses of this soil. Limitations for building sites are moderate because of shrinking and swelling and low strength. Foundations and footings should be properly designed to prevent damage to the structure.

Frost action and low strength severely limit local roads and streets on this soil. These limitations can be partly overcome by proper surface and subsurface drainage systems and by use of a more suitable base material. Limitations for septic tank absorption fields and sanitary landfills are slight. Capability subclass IIe; woodland suitability subclass 1o.

AlC2—Alford silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on long, narrow ridgetops adjacent to drainageways in the uplands. Areas are long and narrow. They range from 3 to 10 acres in size and are dominantly about 5 acres.

In a typical profile, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is about 42 inches thick. The upper 6 inches of the subsoil is yellowish brown, friable silt loam; the next 20 inches is yellowish brown, firm silty clay loam; and the lower 16 inches is yellowish brown, friable silt loam. The substratum to a depth of 72 inches is strong brown silt loam. In places the subsoil is less thick.

Included with this soil in mapping are a few small areas of severely eroded soils.

Available water capacity is very high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for these uses is good if erosion is controlled.

This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, the hazard of erosion is severe. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures can prevent excessive soil loss. Returning crop residue to the soil and planting cover crops reduce runoff and help to control erosion. They also maintain tilth and organic-matter content.

This soil is well suited to grasses and legumes for hay or pasture. The use of this soil for hay or pasture is effective in controlling water erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. A few areas support hardwoods. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well, however, if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the moderate permeability, and the severe hazard of erosion during construction adversely affect engineering uses of this soil. Limitations for building sites are moderate or severe because of slope, shrinking and swelling, and low strength. Properly designing foundations and footings can prevent structural damage. Establishing a plant cover as soon as possible after construction is completed reduces the risk of erosion.

Frost action and low strength severely limit local roads and streets on this soil. These limitations can be partly overcome by installing proper surface and subsurface drainage systems and by strengthening the base material. The slope moderately limits septic tank absorption fields. This limitation generally can be overcome by constructing the absorption field on the contour. Capability subclass IIIe; woodland suitability subclass 1o.

Ar—Armiesburg silty clay loam. This nearly level, deep, well drained and moderately well drained soil is on bottom land. It is subject to frequent flooding. Areas are long and wide. They range from 30 to 225 acres in size and are dominantly about 90 acres.

In a typical profile, the surface layer is very dark brown silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 7 inches thick. The subsoil is about 24 inches thick. The upper 12 inches of the subsoil is dark brown, firm silty clay loam; and the lower 12 inches is dark brown, friable silt loam. The underlying material to a depth of about 62 inches is dark brown silt loam.

Included with this soil in mapping are small areas of Genesee soils on the slightly higher rises near the river. These soils are coarser textured throughout than this Armiesburg soil. Also included are small depressional areas of Eel soils, which are also coarser textured throughout.

Available water capacity is high, and permeability is moderate. Organic-matter content is high in the surface layer. Surface runoff from cultivated areas is slow.

Most areas are intensively used for corn and soybeans. A few areas are used for small grain, hay, and pasture. A few areas are wooded. The potential for farming is good.

This soil is well suited to corn, soybeans, grain sorghum, small grain, and grasses and legumes if it is adequately protected against flooding. Conservation practices are needed. If levees and adequate diversion terraces are built and maintained, a conservation cropping system in which row crops are grown during most years is suitable. Minimum tillage, winter cover crops, and crop residue management maintain and improve organic-matter content and maintain good tilth.

This soil is well suited to grasses and legumes for forage. If the soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the moderate permeability, and the severe hazard of flooding adversely affect engineering uses of this soil. The potential for building site development and sanitary facilities is poor because of the flooding. Capability subclass IIw; woodland suitability subclass 1o.

DaB—Dana silt loam, 1 to 4 percent slopes. This nearly level to gently sloping, deep, moderately well drained soil is on rolling plains in the uplands. Areas are long and narrow or irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 8 acres.

In a typical profile, the surface layer is very dark brown and very dark grayish brown silt loam about 12 inches thick. The subsoil is about 48 inches thick. The upper 8 inches of the subsoil is dark yellowish brown, firm silty clay loam; the next 16 inches is dark yellowish brown, mottled, firm silty clay loam; and the lower 24 inches is dark brown, mottled, firm clay loam and friable loam. The substratum to a depth of about 72 inches is yellowish brown, mottled, friable loam. In places the subsoil is less thick.

Included with this soil in mapping are a few small, depressional areas of the wetter Raub and Sable soils. Also included are small areas of soils that have slopes of more than 4 percent. In some small, severely eroded, steeper areas, the subsoil has been mixed with the surface soil by plowing and the surface layer is silty clay loam.

Available water capacity is high, and permeability is moderately slow. Organic-matter content is high in the surface layer. Surface runoff from cultivated areas is slow to medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture. This soil formed under prairie, and very few areas are in woodland. The potential for all of these uses is good.

This soil is well suited to corn, soybeans, and small grain. Erosion control is needed in areas where slopes are more than 2 percent. Crop rotation, minimum tillage, management of crop residue, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Managing crop residue and planting cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

High potential frost action, the moderate permeability, moderate wetness caused by a seasonal high water table, and a moderate shrink-swell potential adversely affect the engineering uses of this soil.

Limitations for building sites are moderate. Constructing houses without basements, properly designing footings, and installing foundation drain tile can prevent the structural damage caused by shrinking and swelling and low strength. This soil is moderately limited as a septic tank absorption field because it is wet. It is severely limited for local roads and streets by frost action and low strength. Adequate road ditches and measures that strengthen the base material are generally needed. Limitations for building sites, septic tank absorption fields, and local roads and streets can be partly overcome by surface and subsurface drainage systems. Capability subclass IIe; not assigned to a woodland suitability subclass.

Dm—Dumps, mine. This map unit consists of smoothed or uneven piles of waste rock, shale, coal, and refuse from underground coal mines. It cannot support plants without major reclamation. Areas range from 3 to 10 acres in size. The dominant size is about 5 acres.

This map unit is commonly adjacent to upland soils, such as Fincastle, Hennepin, Ragsdale, Reesville, Russell, and Xenia soils. In a few areas it is adjacent to bottom land soils, such as Genesee or Shoals soils. Not assigned to a capability subclass or a woodland suitability subclass.

Ee—Eel silt loam. This nearly level, deep, moderately well drained soil is on narrow flood plains along small streams and in depressions in old oxbows. It is subject to frequent flooding. Areas are long and narrow. They range from 5 to 60 acres in size and are dominantly about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 4 inches thick. The underlying material is, in sequence downward, about 11 inches of dark brown, friable loam; 6 inches of dark brown, mottled, friable loam; 15 inches of dark brown, mottled, very friable sandy loam; and 24 inches of dark brown, mottled, friable loam. In most areas the color, thickness, and texture of underlying material vary within short distances.

Included with this soil in mapping are small areas of well drained Genesee soils on the slightly higher rises nearer the streams. Also included are small depressional areas of the wetter Shoals soils farther away from the streams.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow.

Most areas are used for small grain, hay, and pasture. Some areas are wooded, and a few are used for corn and soybeans. The potential for farming is good.

This soil is well suited to corn, soybeans, small grain, and grasses and legumes if it is adequately protected against flooding. Conservation measures are needed if crops are grown. If levees and adequate diversion terraces are built and maintained, a conservation cropping system in which row crops are grown during most years is suitable. Minimum tillage, winter cover crops, and crop residue management maintain and improve organic-matter content and maintain good tilth.

This soil is well suited to grasses and legumes for forage. If the soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable plants. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the moderate permeability, and the severe hazard of flooding adversely affect the engineering uses of this soil. The soil has poor potential for building site development and sanitary facilities because of flooding. Capability subclass IIw; woodland suitability subclass 1o.

EoA—Elston sandy loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on broad terraces. Areas are long and wide and irregularly shaped. They range from 20 to 450 acres in size and are dominantly about 150 acres.

In a typical profile, the surface layer is sandy loam about 15 inches thick. The upper 10 inches is very dark gray, and the lower 5 inches is very dark brown. The subsoil is about 57 inches thick. The upper 11 inches of the subsoil is dark brown, friable sandy clay loam; the next 10 inches is dark brown, friable sandy loam; and the lower 36 inches is dark brown, very friable loamy sand. The substratum to a depth of about 80 inches is pale brown, loose sand.

Included with this soil in mapping are small areas of sandy soils. Also included are a few small areas of soils that have a loamy sand or loam surface layer. In some small areas slopes are more than 2 percent.

Available water capacity is moderate, and permeability is moderately rapid. Organic-matter content is high in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for small grain and grain sorghum or for hay or pasture, and some are used for corn and soybeans. This soil formed under prairie, and no areas are in woodland. The potential for cultivated crops is fair.

This soil is suited to corn, soybeans, small grain, and grain sorghum. If an adequate water supply is available, it is also suited to irrigated vegetable crops, such as potatoes, tomatoes, and green beans. Droughtiness during years when rainfall is below average or poorly distributed is the major limitation to use and management. A conservation cropping system in which row crops are grown during most years is suitable. Minimum tillage, crop residue management, and early spring planting help to prevent drought damage to crops.

This soil is suited to grasses and legumes for hay or pasture. If the pasture is overgrazed or grazed when the soil is too dry, the plants die out. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

The moderately rapid permeability and a possibility of seepage in the lower part of the subsoil adversely affect engineering uses of this soil. The moderately rapid permeability slightly limits septic tank absorption fields. Limitations for small commercial buildings, residential development, and local roads and streets are slight. Capability subclass IIs; not assigned to a woodland suitability subclass.

EoB—Elston sandy loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on terraces. It formed in loamy outwash more than 5 feet deep over deposits of gravelly sand. Areas are long and wide and irregularly shaped. They range from 3 to 30 acres in size and are dominantly about 15 acres.

In a typical profile, the surface layer is sandy loam about 14 inches thick; the upper 9 inches is very dark gray, and the lower 5 inches is very dark brown. The subsoil is about 55 inches thick. The upper 11 inches of the subsoil is dark brown, friable sandy clay loam; the next 10 inches is dark brown, friable sandy loam; and the lower 34 inches is dark brown, very friable loamy sand. The substratum to a depth of about 80 inches is pale brown, loose sand.

Included with this soil in mapping are small areas of soils that have a sand or loamy sand surface layer. In a few small areas, slopes are more than 6 percent.

Available water capacity is moderate, and permeability is moderately rapid. Organic-matter content is high in the surface layer. Surface runoff from cultivated areas is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn and soybeans, for small grain and grain sorghum or for hay or pasture. This soil formed under prairie, and no areas are in woodland. The potential for cultivated crops is fair.

This soil is suited to corn, soybeans, and grain sorghum. Droughtiness and the risk of erosion are the major concerns of management. Crop rotations, minimum tillage, crop residue management, cover crops, and green manure crops help to conserve moisture and control erosion. Grassed waterways help to control runoff and erosion in some areas.

This soil is suited to grasses and legumes for hay or pasture. If the pasture is overgrazed or grazed when the soil is too dry, the plants die out. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

The moderately rapid permeability and a possibility of seepage in the lower part of the subsoil adversely affect engineering uses of this soil. The moderately rapid permeability is a slight limitation if the soil is used as a septic tank absorption field. Limitations for dwellings with or without basements and for local roads and streets are slight. Limitations for small commercial buildings are moderate if the slope is more than 4 percent. Erosion is a problem in large exposed areas. Establishing a plant cover as soon as possible helps to control erosion. Capability subclass IIe; not assigned to a woodland suitability subclass.

FcA—Fincastle silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil occurs as large, flat areas in the uplands and as small, islandlike areas surrounded by dark, depressional soils. Areas are broad and irregularly shaped. They range from 3 to 250 acres in size and are dominantly about 45 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown, mottled silt loam about 4 inches thick. The subsoil is about 38 inches thick. The upper 8 inches of the subsoil is grayish brown, mottled, firm silty clay loam; the next 18 inches is yellowish brown, mottled, firm silty clay loam; and the lower 12 inches is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 72 inches is yellowish brown and pinkish gray, friable loam.

Included with this soil in mapping are a few slightly depressional areas of the wetter Ragsdale soils and some areas of soils in narrow drainageways. Also included are some small, severely eroded areas on knolls.

Available water capacity is high, and permeability is moderately slow. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay and pasture, and a few support hardwoods. The potential for these uses is good.

If tiled, this soil is suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops maintain organic-matter content and fertility and improve tilth.

If tiled, this soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

This soil is suited to water-tolerant hardwoods. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation and by spraying and girdling.

High potential frost action, the moderately slow permeability, and a seasonal high water table adversely affect engineering uses of this soil. Wetness is a severe limitation for most uses.

An adequate drainage system in combination with storm sewers is needed to lower the water table if buildings are constructed on this soil. Houses should be constructed without basements. Sanitary facilities function poorly unless the water table is lowered. Enlarged septic tank absorption fields are used. If local roads and streets are constructed on this soil, good drainage ditches are needed and the base material should be strengthened to overcome frost action, low strength, and wetness. Capability subclass IIw; woodland suitability subclass 3o.

FgA—Flanagan silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil occurs as large, flat areas in the uplands and as small, islandlike areas surrounded by dark, depressional soils. Areas are long, wide, and irregularly shaped. They range from 3 to 70 acres in size and are dominantly about 25 acres.

In a typical profile, the surface layer is very dark brown silt loam about 12 inches thick. The subsurface layer is very dark gray silt loam about 4 inches thick. The subsoil is about 50 inches thick. The upper 10 inches of the subsoil is very dark grayish brown, mottled, firm silty clay loam; the next 23 inches is very dark grayish brown and light brownish gray, mottled, firm silty clay loam; and the lower 17 inches is mottled yellowish brown and gray, friable silt loam. The substratum to a depth of about 84 inches is yellowish brown and gray, friable loam.

Included with this soil in mapping are small areas of the wetter Sable soils in slight depressions and narrow drainageways and small areas of somewhat poorly drained soils in which the lower part of the subsoil and the upper part of the substratum are sandy loam. Also included are some severely eroded areas and a few areas of very poorly drained soils in depressions.

Available water capacity is very high, and permeability is moderate. Organic-matter content is high in the surface layer. Surface runoff from cultivated areas is medium to slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay and pasture. This soil formed under prairie, and no areas are in woodland. The potential for farming is good.

If tiled, this soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops maintain organic-matter content and fertility and improve tilth.

If tiled, this soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

High potential frost action, a possibility of seepage in the lower part of the subsoil, the moderate permeability, a seasonal high water table, low strength, and shrinking and swelling adversely affect the engineering uses of this soil. Wetness severely limits most uses.

An adequate drainage system in combination with storm sewers and foundation drains is needed to lower the water table. Houses should be constructed without basements. Foundations and footings of other buildings should be designed to prevent the structural damage caused by shrinking and swelling and low strength. Adequate drainage is necessary if septic tank absorption fields are to function properly. Capability subclass IIw; not assigned to a woodland suitability subclass.

FoB2—Fox sandy loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on terraces. It is moderately deep over coarse sand and gravel. Areas are generally broad and irregularly shaped. They range from 5 to 40 acres in size and are dominantly about 15 acres.

In a typical profile, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 31 inches thick. The upper 4 inches of the subsoil is dark yellowish brown, friable loam; the next 15 inches is dark brown, firm clay loam; and the lower 12 inches is dark brown, firm sandy clay loam. The substratum to a depth of 60 inches is yellowish brown, loose, stratified sand and gravel.

Included with this soil in mapping are a few small areas where slopes are more than 6 percent; a few small, severely eroded areas; small areas of gravelly soils; and a few escarpments along the border of mapped areas.

Available water capacity and permeability are moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow to rapid. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farming is fair.

This soil is well suited to corn, soybeans, small grain, and grain sorghum. It is suited to irrigated vegetable crops, such as potatoes, tomatoes, and green beans. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Crop residue management and cover crops help to control erosion, conserve moisture, and improve and maintain tilth and organic-matter content. Droughtiness is a problem in dry periods.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling water erosion. If the pasture is overgrazed or grazed when the soil is too dry, the plants die out. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition slightly limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, the moderate permeability, the low to moderate shrink-swell potential, and a severe hazard of erosion during construction adversely affect engineering uses of this soil.

Limitations for building sites are moderate. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling and low strength. Limitations for septic tank absorption fields are slight. Establishing a plant cover as soon as possible in areas disturbed by construction helps to control erosion. Capability subclass IIIe; woodland suitability subclass 1o.

FoC2—Fox sandy loam, 6 to 12 percent slopes, eroded. This moderately sloping, well drained soil is on terraces. It is moderately deep over coarse sand and gravel. Areas are long and narrow and irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 10 acres.

In a typical profile, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 29 inches thick. The upper 4 inches of the subsoil is dark yellowish brown, friable loam; the next 15 inches is dark brown, firm clay loam; and the lower 10 inches is dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose, stratified sand and gravel.

Included with this soil in mapping are a few small areas where slopes are more than 12 percent; a few small, severely eroded areas; a few small areas of gravelly soils; and a few escarpments along the border of mapped areas.

Available water capacity and permeability are moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is rapid. Reaction varies widely in the surface layer as a result of local liming practices.

Many areas are used for hay or pasture. A few areas support hardwoods. The potential for farming is fair, and the potential for woodland is good.

This soil is suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Crop residue management and cover crops help to control erosion, conserve moisture, and improve and maintain tilth and organic-matter content. Droughtiness is a problem in dry periods.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling water erosion. If the pasture is overgrazed or grazed when the soil is too dry, the plants die out and runoff is excessive. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, the moderate permeability, a moderate shrink-swell potential, and a severe hazard of erosion during construction adversely affect engineering uses of this soil. Limitations for building sites are moderate. Foundations and footings of dwellings should be designed to prevent the structural damage caused by shrinking and swelling and low strength. The base material for local roads and streets can be strengthened with more suitable material.

The slope moderately limits septic tank absorption fields. Fields should be constructed on the contour. Establishing a plant cover as soon as possible in areas disturbed by construction helps to control erosion. Capability subclass IIIe; woodland suitability subclass 1o.

FsA—Fox loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad terraces. It is moderately deep over coarse sand and gravel. Areas are broad and irregularly shaped. They range from 3 to 100 acres in size and are dominantly about 25 acres.

In a typical profile, the surface layer is dark brown loam about 8 inches thick. The subsurface layer is dark brown loam about 3 inches thick. The subsoil is dark brown, firm gravelly clay loam about 23 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose, stratified sand and gravel.

Included with this soil in mapping are small areas of the deeper, well drained Ockley soils. Also included are dark colored, well drained soils in slight depressions and narrow drainageways and a few gravel spots.

Available water capacity and permeability are moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow to rapid. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farming is fair.

This soil is well suited to corn, soybeans, small grain, and grain sorghum. It is suited to irrigated vegetable crops, such as potatoes, tomatoes, and green beans. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content, conserve moisture and fertility, and improve tilth. Drought can be a problem in some seasons.

This soil is well suited to grasses and legumes for hay and pasture. If the pasture is overgrazed or grazed when the soil is too dry, plants die out. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, the moderate permeability, and the moderate shrink-swell potential adversely affect engineering uses of this soil. Limitations for dwellings with or without basements are moderate. Foundations and footings should be designed to prevent the structural damage caused by shrinking and swelling and low strength. The base material for local roads and streets should be strengthened with more suitable material. Limitations for septic tank absorption fields are slight. Capability subclass IIs; woodland suitability subclass 1o.

FxC3—Fox clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, well drained soil is on terraces. It is moderately deep over coarse sand and gravel. Areas are long and narrow and irregularly shaped. They range from 3 to 12 acres in size and are dominantly about 7 acres.

In a typical profile, the surface layer is dark brown clay loam about 4 inches thick. The subsoil is about 30 inches thick. The upper 4 inches of the subsoil is dark yellowish brown, firm clay loam; the next 15 inches is dark brown, firm clay loam; and the lower 11 inches is dark brown, firm gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose, stratified sand and gravel.

Included with this soil in mapping are a few small areas where slopes are more than 12 percent, a few small gullies, gravel spots, and a few escarpments along the border of mapped areas.

Available water capacity and permeability are moderate. Organic-matter content is low in the surface layer. Surface runoff from cultivated areas is rapid. Reaction varies widely in the surface layer as a result of local liming practices.

Many areas are used for hay or pasture. Some areas are farmed, and few support hardwoods. The potential for cultivated crops is fair, and the potential for pasture and woodland is good.

This soil is not well suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures are needed to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling water erosion. If the pasture is overgrazed or grazed when the soil is too dry, the plants die out and runoff is excessive. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition slightly limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, the moderate permeability, a moderate shrink-swell potential, and a severe hazard of erosion during construction adversely affect the engineering uses of this soil. Limitations for dwellings with or without basements are moderate. Foundations and footings should be designed to prevent the structural damage caused by shrinking and swelling and low strength. The base material for local roads and streets should be strengthened with more suitable material.

The slope moderately limits septic tank absorption fields. Fields should be constructed on the contour. Establishing a plant cover as soon as possible in areas disturbed by construction helps to control erosion. Capability subclass IVe; woodland suitability subclass 1o.

Ge—Genesee silt loam. This nearly level, deep, well drained soil is on bottom land (fig. 6). It is subject to flooding. Areas are long and wide or irregularly shaped. They range from 10 to 300 acres in size and are dominantly about 50 acres.

In a typical profile, the surface layer is dark brown silt loam 10 inches thick. The underlying material is, in sequence downward, about 8 inches of dark yellowish brown, friable loam; 38 inches of dark brown, friable silt loam; and 16 inches of dark yellowish brown, friable silt loam.

Included with this soil in mapping are small areas of Stonelick soils on the slightly higher rises nearer the streams. These soils are sandier throughout than this Genesee soil. Also included are small depressional areas of the wetter Eel, Shoals, and Sloan soils farther away from the streams.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff is slow.

Most areas are intensively used for corn and soybeans. A few areas are used for small grain, hay, and pasture. A few areas are wooded. The potential for farming is good.

This soil is well suited to corn, soybeans, small grain, and grasses and legumes if it is adequately protected against flooding. Conservation practices are needed if crops are grown. If levees and adequate diversion terraces are built and maintained, a conservation cropping system in which row crops are grown during most years is suitable. Minimum tillage, winter cover crops, and crop residue management maintain and improve organic-matter content and maintain good tilth.

This soil is well suited to grasses and legumes for forage. If the soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, additions of lime and fertilizer, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, the moderate permeability, and a severe hazard of flooding adversely affect engineering uses of this soil. The potential for building site development and sanitary facilities is poor because of flooding. Capability subclass IIw; woodland suitability subclass 1o.

GpG—Gosport shaly silt loam, 50 to 70 percent slopes. This very steep, moderately well drained soil is on upland side slopes. It is moderately deep over shale and bedrock. Areas are long and narrow or irregularly shaped. They range from 10 to 50 acres in size and are dominantly about 20 acres.

In a typical profile, the surface layer is very dark brown shaly silt loam about 3 inches thick. The subsurface layer is grayish brown shaly silty clay loam about 6 inches thick. The subsoil is about 16 inches thick. The upper 7 inches of the subsoil is olive brown, firm shaly silty clay loam, and the lower 9 inches is olive, firm shaly silty clay loam. The substratum to a depth of about 40 inches is light olive gray clay shale.

Included with this soil in mapping are small areas where slopes are less than 50 percent. Also included are areas where bedrock is exposed and areas of gravelly soils.

Available water capacity is low, and permeability is very slow. Organic-matter content is low. Surface runoff is rapid. The surface layer is slightly acid or medium acid.

This soil is in woodland (fig. 7). It is generally not suited to corn, soybeans, small grain, or forage crops, because slopes are very steep and the hazard of erosion is severe.

This soil is suited to trees. The equipment limitation is moderate, and the hazards of erosion, seedling mortality, and windthrow are moderate. Seedlings survive and grow well, however, if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation and by spraying, cutting, and girdling. Excluding livestock from areas of this soil helps in controlling erosion.

The very steep slopes, a severe erosion hazard during construction, low strength, the shrink-swell potential, and a moderate depth to rock adversely affect engineering uses of this soil. The very steep slopes, the depth to rock, the low strength, and the shrink-swell potential severely limits all sanitary facilities and community developments. Capability subclass VIIIe; woodland suitability subclass 5d.

HeF—Hennepin loam, 25 to 50 percent slopes. This steep and very steep, deep, well drained soil is on upland side slopes. Areas are long and narrow or irregularly shaped. They range from 5 to 25 acres in size and are dominantly about 15 acres.

In a typical profile, the surface layer is dark gray loam about 5 inches thick. The subsoil is dark brown, friable loam about 8 inches thick. The substratum to a depth of about 60 inches is brown and gray, mottled, friable loam.

Included with this soil in mapping are small areas where slopes are less than 25 percent. Also included are small areas where rock crops out, small areas of gravelly soils, and severely eroded areas.

Permeability is moderately slow, and available water capacity is moderate. Organic-matter content is moderate in the surface layer. Surface runoff is rapid to very rapid. The surface layer is neutral or mildly alkaline.

This soil is in woodland (fig. 8). It is generally not suited to row crops, small grain, or forage crops because slopes are steep or very steep and the hazard of erosion is severe. It has good potential for woodland.

This soil is well suited to trees. The equipment limitation is severe. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation and by spraying and girdling.

The steep or very steep slopes and the severe hazard of erosion during construction adversely affect engineering uses of this soil. The slope severely limits buildings or sanitary facilities. Capability subclass VIIe; woodland suitability subclass 1r.

HgB—High Gap silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on narrow terraces. It is moderately deep over bedrock. Areas are long and narrow or irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 12 acres.

In a typical profile, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 30 inches thick; it is yellowish brown and pale brown, firm clay loam in the upper 26 inches and yellowish brown, firm channery clay loam in the lower 4 inches. Sandstone bedrock is at a depth of about 38 inches.

Included with this soil in mapping are a few small areas of Fox soils, which are underlain by sand and gravel, and some rock outcrops and escarpments. Also included are small areas of soils that have slopes of more than 6 percent.

Available water capacity and permeability are moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow to moderate, depending on slope. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for hay and pasture, and some are used for corn, soybeans, and small grain. A few areas support hardwoods. The potential for cultivated crops is fair, and the potential for woodland and pasture is good.

This soil is suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures are needed to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition slightly limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

The shrink-swell potential, the low strength, the moderate permeability, the depth to bedrock, and the hazard of erosion during construction in areas where slopes are more than 2 percent adversely affect engineering uses of this soil. The soil is severely limited for local roads and streets by low strength and moderately limited for dwellings without basements by low strength and the shrink-swell potential. The limitations for local roads and streets can be partly overcome by strengthening the base material with more suitable material.

The depth to rock severely limits septic tank absorption fields and dwellings with basements. In places septic tank absorption fields can be located on adjacent deeper soils. Capability subclass IIIe; woodland suitability subclass 3o.

IpA—Ipava silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil occurs as large, flat areas in the uplands and as small, islandlike areas surrounded by dark, depressional soils. Areas are long and wide or irregularly shaped. They range from 3 to 100 acres in size and are dominantly about 35 acres.

In a typical profile, the surface layer is very dark brown and very dark gray silt loam about 12 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 33 inches thick; it is, in sequence downward, 8 inches of dark grayish brown, mottled, firm silty clay loam; 6 inches of light brownish gray, mottled, firm silty clay loam; 11 inches of grayish brown, mottled, firm silty clay loam; and 8 inches of light gray, mottled, friable silt loam. The substratum to a depth of about 72 inches is light gray, mottled, friable silt loam.

Included with this soil in mapping are small areas of the wetter Sable soils in slight depressions and narrow drainageways and small areas of soils that have slopes of more than 2 percent. Also included are some severely eroded areas on mounds.

Available water capacity is very high, and permeability is moderately slow. Organic-matter content is high in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain and some are used for hay and pasture. This soil formed under prairie, and no areas are in woodland. The potential for farm crops is good.

If tiled, this soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops maintain organic-matter content and fertility and improve tilth.

If adequately drained, this soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

High potential frost action, the moderately slow permeability, a seasonal high water table, low strength, and the shrink-swell potential adversely affect engineering uses of this soil. Wetness severely limits most uses. An adequate drainage system in combination with storm sewers and foundation drains is needed to lower the water table.

Houses should be constructed without basements. Foundations and footings of other buildings should be designed to prevent the structural damage caused by shrinking and swelling and low strength. Adequate drainage is necessary before septic tank absorption fields can function properly. Capability subclass IIw; not assigned to a woodland suitability subclass.

McA—Martinsville loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on broad terraces. Areas are long and wide or irregularly shaped. They range from 5 to 100 acres in size and are dominantly about 30 acres.

In a typical profile, the surface layer is dark brown loam about 8 inches thick. The subsurface layer is dark yellowish brown loam about 5 inches thick. The subsoil is firm clay loam about 47 inches thick; the upper 17 inches is dark brown, and the lower 30 inches is dark yellowish brown and yellowish brown. The substratum to a depth of about 72 inches is yellowish brown, stratified fine sand and sandy clay loam.

Included with this soil in mapping are a few small areas of the wetter Whitaker soils; a few small areas of soils that have a sandy loam surface layer; and a few small, long and narrow, depressional areas of well drained soils that have a silt loam surface layer. Also included are small areas of well drained soils that are capped with 20 to 40 inches of loess.

Available water capacity is high, and permeability is moderate. Organic matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farming is good.

This soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content, conserve moisture and fertility, and improve tilth.

This soil is well suited to grasses and legumes for hay and pasture. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods keep the pasture and the soil in good condition.

This soil is well suited to trees. It is moderately limited by plant competition and the hazard of windthrow. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

Seepage, frost action, low strength, and shrinking and swelling adversely affect engineering uses of this soil. Limitations for septic tank absorption fields are slight. The low strength and the shrink-swell potential moderately limit dwellings with or without basements and small commercial buildings. Foundations and footings of buildings should be designed to prevent the structural damage caused by shrinking and swelling and low strength.

Frost action, low strength, and shrinking and swelling moderately limit local roads and streets. The base material for roads should be strengthened with more suitable material. Capability class I; woodland suitability subclass 1o.

McB2—Martinsville loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on broad terraces. Areas are long and narrow or irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 10 acres.

In a typical profile, the surface layer is dark brown loam about 7 inches thick. The subsurface layer is dark yellowish brown loam about 5 inches thick. The subsoil is firm clay loam about 44 inches thick; the upper 17 inches is dark brown, and the lower 27 inches is dark yellowish brown and yellowish brown. The substratum to a depth of about 72 inches is yellowish brown, stratified fine sand and sandy clay loam.

Included with this soil in mapping are a few small areas of soils that have a sandy loam, silt loam, or sand surface layer and a few areas of soils that have slopes of more than 6 percent.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farming is good.

This soil is well suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

Seepage, frost action, low strength, and shrinking and swelling adversely affect engineering uses of this soil. Limitations for septic tank absorption fields are slight. The low strength and the shrinking and swelling moderately limit dwellings with or without basements and small commerical buildings. Foundations and footings should be designed to prevent the structural damage caused by shrinking and swelling and low strength.

Frost action, low strength, and shrinking and swelling moderately limit local roads and streets. Good drainage ditches should be provided and the base material should be strengthened. Capability subclass IIe; woodland suitability subclass 1o.

MeD2—Miami silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on ridges and side slopes in the uplands. Areas are long and narrow or irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 12 acres.

In a typical profile, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is about 22 inches thick. The upper 9 inches of the subsoil is yellowish brown and brown, firm clay loam; and the lower 13 inches is dark yellowish brown and yellowish brown, firm sandy clay loam. The substratum to a depth of about 60 inches is pale brown, friable loam till.

Included with this soil in mapping are a few small, severely eroded areas; small, very steep areas; and some areas of soils that have slopes of less than 12 percent.

Available water capacity is high. Permeability is moderate in the solum and moderately slow in the substratum. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is rapid. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for pasture. A few areas are planted to corn, soybeans, and small grain, and a few support hardwoods. This soil has better potential for pasture or woodland than for most other uses.

This soil is not well suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, contour farming, diversions, and grassed waterways help to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, the moderate permeability in the subsoil and moderately slow permeability in the substratum, and a severe hazard of erosion during construction adversely affect engineering uses of this soil. The slope severely limits buildings. The slope and low strength severely limit local roads and streets. The slope can be partly overcome by constructing all facilities on the contour and by selecting less sloping areas. The soil should be reinforced with a stronger base material if local roads and streets are built.

The slow absorption of liquid waste and the slope severely limit septic tank absorption fields. The absorption field should be enlarged and located in a less sloping area if possible. Establishing a plant cover as soon as possible in disturbed areas helps to control erosion during construction. Capability subclass IVe; woodland suitability subclass 1o.

MsC3—Miami clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on ridgetops and side slopes in the uplands. Areas are long and moderately wide or are irregularly shaped. They range from 3 to 12 acres in size and are dominantly about 8 acres.

In a typical profile, the surface layer is dark yellowish brown clay loam about 4 inches thick. The subsoil is about 22 inches thick. The upper 9 inches of the subsoil is brown, firm clay loam; and the lower 13 inches is dark yellowish brown and yellowish brown, firm sandy clay loam. The substratum to a depth of about 48 inches is yellowish brown, firm clay loam till.

Included with this soil in mapping are small areas of soils that have a silt loam surface layer and areas where slopes are more than 12 percent. Also included are a few deep gullies where the underlying material is exposed.

Available water capacity is high. Permeability is moderate in the solum and moderately slow in the substratum. Organic-matter content is low in the surface layer. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for hay or pasture. A few areas are planted to corn, soybeans, and small grain, and a few support hardwoods. This soil has better potential for woodland than for most other uses.

This soil is not well suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, contour farming, diversions, and grassed waterways help to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, additions of lime and fertilizer according to soil tests and plant needs, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, the moderate permeability in the subsoil and moderately slow permeability in the substratum, and a severe hazard of erosion during construction adversely affect engineering uses of this soil. Slope, low strength, and shrinking and swelling moderately limit buildings. All facilities should be built on the contour. Properly designing foundations and footings and basement walls and installing foundation drain tile help to prevent the structural damage caused by frost action, shrinking and swelling, and low strength.

The slow absorption of liquid waste severely limits septic tank absorption fields. Enlarging the filter field helps to overcome this limitation. Lateral seepage on top of the till occurs in poorly designed systems, and liquids can travel several feet before surfacing. The base material for local roads and streets should be strengthened with more suitable material. Establishing a plant cover as soon as possible in disturbed areas helps to control erosion during construction. Capability subclass IVe; woodland suitability subclass 1o.

MsD3—Miami clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on long, narrow side slopes and ridges in the uplands. Areas are long and moderately wide or are irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 12 acres.

In a typical profile, the surface layer is dark yellowish brown clay loam about 4 inches thick. The subsoil is about 22 inches thick. The upper 9 inches of the subsoil is brown, firm clay loam; and the lower 13 inches is dark yellowish brown and yellowish brown, firm sandy clay loam. The substratum to a depth of about 48 inches is yellowish brown, firm clay loam till.

Included with this soil in mapping are steep areas, small areas of soils that have a silt loam surface layer and are only moderately eroded, and areas where slopes are less than 12 percent. Also included are a few deep gullies where the underlying material is exposed.

Available water capacity is moderate. Permeability is moderate in the solum and moderately slow in the substratum. Organic-matter content is low in the surface layer. Surface runoff from cultivated areas is rapid. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are in pasture. A few small areas are planted to corn, soybeans, and small grain. A few areas support hardwoods. This soil has better potential for pasture or woodland than for most other uses.

This soil is not well suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, diversions, contour farming, and grassed waterways help to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes excessive runoff and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

This soil is well suited to trees. The equipment limitation is slight. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, the moderate permeability in the subsoil and moderately slow permeability in the substratum, and a severe hazard of erosion during construction adversely affect engineering uses of this soil. The slope severely limits buildings. The slope and low strength severely limit local roads and streets. The slope can be partly overcome by constructing all facilities on the contour and by selecting less sloping areas. The soil should be reinforced with more suitable base material if local roads and streets are built.

The slow absorption of liquid waste and the slope severely limit septic tank absorption fields. These limitations can be partly overcome by building the sanitary facilities on the contour, by selecting less sloping areas, and by providing a large absorption field. Establishing a plant cover as soon as possible in disturbed areas helps to control erosion during construction. Capability subclass VIe; woodland suitability subclass 1o.

OcA—Ockley silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on moderately wide terraces. It is underlain by stratified sand and gravelly sand. Areas are generally long and narrow or irregularly shaped. They range from 5 to 100 acres in size and are dominantly about 25 acres.

In a typical profile, the surface layer is dark brown silt loam about 7 inches thick. The subsurface layer is dark brown silt loam about 4 inches thick. The subsoil is about 47 inches thick. It is, in sequence downward, about 6 inches of brown, firm silt loam; 15 inches of dark brown, firm clay loam; 14 inches of dark brown, firm sandy clay loam; and 12 inches of dark brown, firm gravelly clay loam. The substratum to a depth of about 72 inches is yellowish brown coarse sand and very gravelly coarse sand.

Included with this soil in mapping are small areas of well drained Fox soils. Also included are a few areas where the surface layer is sandy loam and areas where the surface is gravelly.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for all of these uses is good.

This soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content and fertility and improve tilth.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

The moderate permeability, the shrink-swell potential, low strength, and seepage adversely affect engineering uses of this soil. The shrink-swell potential and the low strength moderately limit building sites. Foundations and footings should be designed to prevent the structural damage caused by shrinking and swelling and low strength.

The low strength severely limits local roads and streets. The base material should be strengthened with more suitable material. Limitations for septic tank absorption fields are slight. Capability class I; woodland suitability subclass 1o.

OcB—Ockley silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on moderately wide terraces. Areas are generally long and narrow or irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 7 acres.

In a typical profile, the surface layer is dark brown silt loam about 5 inches thick. The subsoil is about 42 inches thick. It is, in sequence downward, about 6 inches of brown, firm silt loam; 12 inches of dark brown, firm clay loam; 10 inches of dark brown, firm sandy clay loam; and 14 inches of dark brown, firm gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose coarse sand and gravelly coarse sand.

Included with this soil in mapping are small areas of well drained Fox soils, areas where the surface layer is sandy loam, and small areas where the surface is gravelly.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farm crops is good.

This soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content and fertility and improve tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable species. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

The moderate permeability, the shrink-swell potential, low strength, and seepage adversely affect engineering uses of this soil. The shrink-swell potential and the low strength moderately limit buildings on this soil. Foundations and footings should be designed to prevent the structural damage caused by shrinking and swelling and low strength.

The low strength severely limits local roads and streets. The base material should be strengthened with more suitable material. Limitations for septic tank absorption fields are slight. Capability subclass IIe; woodland suitability subclass 1o.

OrB—Orthents, loamy, 0 to 8 percent slopes. These nearly level to moderately sloping, deep, well drained and moderately well drained soils are in disturbed areas on uplands and terraces. They are around highway interchanges, roadbanks, building sites, and strip mines. Areas range from 3 to 1,600 acres in size; they are dominantly about 60 acres.

In some places, deep cuts have been made in the original land surface and the soil material is used to fill the lower lying areas and to provide a smoother, more level landform, especially around highways. In other places, the soil material has been removed and used as fill or as material in highway grades, overpasses, and exit ramps. Building sites are prepared by leveling an area or filling a deep ravine with soil material. In the modern stripping process used in the surface mining of coal, deep pits are filled with soil material and spoil areas are leveled.

In a typical area of fill around highway interchanges and building sites, the surface layer, subsoil, and substratum are mixed. Texture is silt loam, loam, and clay loam that in places contain some gravel, shale, or stones. In a typical area where a deep cut has been made, the material is mainly loam or clay loam glacial till. In a typical area around strip mines, the material is mainly a mixture of glacial loam till, rock and shale fragments, and small fragments of coal.

Included with these soils in mapping around highway cuts, interchanges, and building sites are small areas where slopes are short and are steeper and outcrops of sandstone and shale. Also included are small areas around strip mines where slopes are more than 8 percent and some deep pits that are filled with water. These pits generally are in areas where coal mining has ceased.

Available water capacity is moderate, and permeability is moderate or moderately slow. Organic-matter content is low in the surface material. Reaction is slightly acid to mildly alkaline in all areas except the strip mines. It is neutral to strongly alkaline around the strip mines.

Most areas around highway interchanges, roadbanks, and building sites support permanent grass or low-growing shrubs, which help to control erosion. Access to most areas is too limited for the production of farm crops. Special management is needed for leveled strip mine areas. An intensified fertility program that emphasizes incorporation of organic residue or manure is needed if these areas are to produce row crops. Erosion control is needed in the gently sloping and moderately sloping areas. Crop rotation, contour farming, minimum tillage, terraces, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Crop residue management, green manure crops, and cover crops help to control erosion, conserve moisture, improve tilth, and increase organic-matter content.

The use of these soils for grasses and legumes is effective in controlling erosion around leveled strip mine areas. An intensified fertility program is also needed if these areas are used for forage crops. Proper livestock stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

These soils are suited to trees. Because the practice of leveling strip mine areas is new, no trees are mature and the data on woodland is incomplete. Suggestions about trees to plant are based on observations of the growth of certain species planted in the past. More information can be obtained from the County Extension Agent, the Soil Conservation Service, or the State Forester.

The slope, moderate to high potential frost action, the moderate or moderately slow permeability, and a severe hazard of erosion during construction adversely affect engineering uses of these soils. Onsite investigation is needed before buildings are constructed. The frost action potential should be determined. Frost action can be partly overcome by surface and subsurface drainage systems. The soil properties significant in the design of a structure vary from one location to another. Engineering test data should be collected. If the soils are used as a building site, removal of vegetation should be held to a minimum and protective plant cover should be established as soon as possible so that erosion losses can be minimized. Some drainage is needed in some nearly level areas.

If these soils are used as a site for sanitary facilities, limitations vary. Onsite investigation is needed. The wetness and permeability in nearly level areas and the slope and permeability in gently sloping and moderately sloping areas should be considered. Capability subclass IIIe.

OrG—Orthents, loamy, 33 to 90 percent slopes. These steep to very steep, deep, well drained soils are in disturbed areas on uplands. They are unleveled spoil left from the old stripping process used in surface mining of clay and coal. Areas range from 3 to 500 acres in size; they are dominantly about 90 acres.

In a typical area, the soil material is mainly a mixture of loam glacial till, rock and shale fragments, and small fragments of clay and coal.

Included with these soils in mapping are small areas where slopes are less than 33 percent. Also included are some long, narrow, deep pits that are filled with water. In some areas these pits are surrounded by spoil. Pits are also evident in areas where clay and coal mining has ceased.

Available water capacity is moderate, and permeability is moderate or moderately slow. Organic-matter content is low in the surface material. Reaction is mainly slightly acid to neutral, but in some areas it ranges from moderately alkaline to very strongly acid.

These soils are not suited to any farm crops because slopes are steep to very steep and the hazard of erosion is severe. They have limited potential for woodland.

These soils are suited to hardwoods and pine (fig. 9). Several species of hardwoods and a few species of pine are in the older stands. Hardwoods, such as ash, maple, poplar, and sycamore, are common. Pine species, such as Scotch pine and Virginia pine, also are common. Further information can be obtained from the County Extension Agent, the Soil Conservation Service, or the State Forester.

The slope, the moderate to moderately slow permeability, and the severe hazard of erosion during construction adversely affect engineering uses of these soils. The potential for these uses is poor because slopes are steep to very steep. Capability subclass VIIe.

Pa—Palms muck. This nearly level, deep, very poorly drained soil is on old oxbows of rivers and creeks. Areas are irregularly shaped or long and narrow. Except for one 60-acre area, they range from 3 to 10 acres in size; they are dominantly about 4 acres.

In a typical profile, the surface layer is black, sticky muck about 17 inches thick. The organic material between depths of 17 and 40 inches is black muck. The underlying material to a depth of 72 inches is gray, mottled, firm light clay loam.

Included with this soil in mapping are small areas of a very poorly drained muck that is more than 50 inches deep over mineral soil, small areas of very poorly drained Sloan soils, and small areas of somewhat poorly drained Shoals soils.

Available water capacity is very high. Permeability is moderately rapid in the organic material and moderate in the underlying material. Organic-matter content is very high in the surface layer. Surface runoff from cultivated areas is ponded to very slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain, and some are used for hay and pasture. If drained, this soil has good potential for farming.

If tiled, this soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops maintain organic-matter content and fertility and improve tilth.

If tiled, this soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

This soil is suited to water-tolerant hardwoods. Equipment limitations, seedling mortality, windthrow, and plant competition are severe. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation and by spraying, cutting, and girdling.

Wetness, the moderately rapid to moderate permeability, flooding, and low strength adversely affect engineering uses of this soil. Wetness and flooding severely limit septic tank absorption fields. Wetness, flooding, and low strength severely limit dwellings with basements and local roads and streets. Soils that are less severely limited should be selected for these uses. Capability subclass IIw; woodland suitability subclass 4w.

Pg—Pits, gravel. This map unit consists of open excavations from which soil and, commonly, underlying sand and gravel have been removed, exposing either sand or gravel that supports few or no plants. Areas range from 3 to 70 acres in size; they are dominantly about 10 acres. Included in mapping are a few small water holes. This map unit is commonly adjacent to soils on terraces, such as Elston, Fox, Rodman, Shipshe, and Wea soils.

PlA—Plano silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained and moderately well drained soil is on outwash plains. Areas are generally long and irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 10 acres.

In a typical profile, the surface layer is very dark brown silt loam 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil is about 34 inches thick. It is, in sequence downward, about 7 inches of dark brown, friable silt loam; 11 inches of dark yellowish brown, firm silty clay loam; 10 inches of dark yellowish brown, mottled silty clay loam; and 6 inches of yellowish brown, mottled, friable silt loam. The substratum to a depth of about 72 inches is dark brown, friable, stratified sandy loam and fine sand.

Included with this soil in mapping are small areas of very poorly drained Sable silty clay loam along drainageways and Proctor silt loam on small knolls and some areas of severely eroded soils.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain, and some are used for hay or pasture. This soil formed under prairie, and no areas are in woodland. The potential for farming is good.

This soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content and fertility and improve tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, additions of lime and fertilizer according to soil tests and plant needs, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

High potential frost action, wetness, seepage, the shrink-swell potential, and low strength adversely affect engineering uses of this soil. The shrink-swell potential and the low strength moderately limit building sites. Properly designing foundations and footings and basement walls and installing foundation drain tile help to prevent the structural damage caused by shrinking and swelling and low strength.

Frost action and low strength severely limit local roads and streets. These limitations can be partly overcome by installing a proper drainage system and by reinforcing the soil with stones or replacing the base material with more suitable material. Limitations for septic tank absorption fields are slight. Capability class I; not assigned to a woodland suitability subclass.

PrC—Princeton fine sandy loam, 8 to 15 percent slopes. This moderately sloping, deep, well drained soil is on ridgetops and side slopes in the uplands. Areas are generally irregularly shaped or round. They range from 3 to 25 acres in size and are dominantly about 10 acres.

In a typical profile, the surface layer is dark brown fine sandy loam 6 inches thick. The subsurface layer is dark yellowish brown fine sandy loam about 5 inches thick. The subsoil is about 33 inches thick. The upper 8 inches of the subsoil is strong brown, firm sandy clay loam; the next 16 inches is dark brown, firm sandy clay loam; and the lower 9 inches is strong brown, friable sandy loam. The substratum to a depth of about 68 inches is yellowish brown, loose fine sand with a few bands of dark brown, friable sandy loam.

Included with this soil in mapping are small areas of soils that have a loamy fine sand surface layer and areas where slopes are less than 8 percent or more than 15 percent. Also included are a few deep gullies.

Available water capacity is moderate. Permeability is moderate in the solum and moderately rapid in the substratum. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for hay or pasture. A few areas are used for corn, soybeans, and small grain, and a few support hardwoods. The potential for farming is fair.

This soil is suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, severe seepage, low strength, and a hazard of erosion during construction adversely affect engineering uses of this soil. The slope moderately or severely limits building sites. Slope can be partly overcome by constructing all facilities on the contour. Shallow excavations tend to cave in. Small commercial buildings should be constructed in the less sloping areas.

Frost action, low strength, and slope moderately limit local roads and streets on this soil. These limitations can be overcome by constructing good road ditches to reduce frost action, reinforcing the base material with more suitable material, and constructing roads on the contour. The slope moderately limits septic tank absorption fields. This limitation can be partly overcome by installing the sanitary facilities on the contour or by selecting less sloping areas. All disturbed areas should be smoothed and planted as soon as possible to reduce the risk of erosion. Capability subclass IVe; woodland suitability subclass 1o.

PtA—Proctor silt loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained and well drained soil is on outwash plains in the uplands. Areas are long and narrow or irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 10 acres.

In a typical profile, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 5 inches thick. The subsoil is about 37 inches thick. The upper 5 inches of the subsoil is dark brown, friable silt loam; the next 16 inches is dark yellowish brown, firm silty clay loam; and the lower 16 inches is dark yellowish brown, friable, stratified silt loam and loam. The substratum to a depth of about 72 inches is strong brown, friable, stratified sandy loam and loam.

Included with this soil in mapping are a few small areas of very poorly drained Sable soils in depressions. Also included are severely eroded areas.

Available water capacity is high, and permeability is moderate. Organic-matter content is high in the surface layer. Surface runoff is slow or medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, or small grain or for grasses and legumes for forage. The soil formed under prairie, and no areas are in woodland. The potential for farming is good.

This soil is well suited to corn, soybeans, and small grain. If well managed, it is suited to intensive row cropping. Minimum tillage and crop residue management improve and maintain tilth and organic-matter content.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during dry periods reduce surface compaction and maintain good tilth and plant density.

High potential frost action, wetness, seepage, low strength, and a moderate shrink-swell potential adversely affect engineering uses of this soil. The shrinking and swelling, the low strength, and the wetness moderately limit housing developments. The wetness can be partly overcome by lowering the water table through an adequate drainage system in combination with storm sewers and foundation drains. Houses should be constructed without basements. Foundations and footings of other buildings should be designed to prevent the structural damage caused by shrinking and swelling and low strength.

Frost action and low strength severely limit local roads and streets on this soil. These limitations can be partly overcome by installing good drainage ditches and by reinforcing the soil with stones or replacing it with more suitable base material. The wetness severely limits septic tank absorption fields. This limitation can be overcome by lowering the water table and enlarging the septic tank absorption field. Capability class I; not assigned to a woodland suitability subclass.

PtB—Proctor silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained and moderately well drained soil is on outwash plains. Areas are long and narrow or irregularly shaped. They range from 3 to 12 acres in size and are dominantly about 8 acres.

In a typical profile, the surface layer is very dark brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown silt loam about 4 inches thick. The subsoil is about 32 inches thick. The upper 4 inches of the subsoil is dark brown, friable silt loam; the next 14 inches is dark yellowish brown, firm silty clay loam; and the lower 14 inches is dark yellowish brown, friable, stratified silt loam and loam. The substratum to a depth of about 67 inches is strong brown, stratified sandy loam and loam.

Included with this soil in mapping are a few small areas of very poorly drained Sable soils in depressions.

Available water capacity is high, and permeability is moderate. Organic-matter content is high in the surface layer. Surface runoff is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, or small grain or for grasses and legumes for forage. This soil formed under prairie, and no areas are in woodland. The potential for farm crops is good.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main problem that affects use and management. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures are needed to prevent excessive soil loss. Minimum tillage and crop residue management improve and maintain tilth and organic-matter content.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during dry periods reduce surface compaction and maintain good tilth and plant density.

Frost action, wetness, seepage, low strength, and shrinking and swelling adversely affect engineering uses of this soil. The shrinking and swelling, the low strength, and the wetness moderately limit housing developments. The wetness can be partly overcome by lowering the water table through an adequate drainage system in combination with storm sewers and foundation drains. Houses should be constructed without basements. Foundations and footings of other buildings should be designed to prevent the structural damage caused by shrinking and swelling and low strength.

Frost action and low strength severely limit local roads and streets on this soil. These limitations can be partly overcome by installing good drainage ditches and by reinforcing the soil with stones or replacing it with more suitable base material. The wetness severely limits septic tank absorption fields. This limitation can be overcome by lowering the water table and enlarging the septic tank absorption field. Capability subclass IIe; not assigned to a woodland suitability subclass.

Ra—Ragsdale silt loam. This nearly level, deep, very poorly drained soil occupies slightly depressional areas in the uplands. Areas are generally broad and irregularly shaped. They range from 3 to 450 acres in size and are dominantly about 200 acres.

In a typical profile, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 5 inches thick. The subsoil is mottled, firm silty clay loam about 33 inches thick; the upper 5 inches is very dark gray, the next 16 inches is grayish brown, and the lower 12 inches is yellowish brown. The substratum to a depth of 80 inches is 11 inches of mottled grayish brown and yellowish brown silt loam over 23 inches of yellowish brown, mottled loam.

Included with this soil in mapping are a few small areas of somewhat poorly drained Fincastle and Reesville soils. Also included, in depressions, are some areas of soils that are wetter than this Ragsdale soil.

Available water capacity is high, and permeability is slow. Organic-matter content is high in the surface layer. Surface runoff is ponded or very slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, or small grain or for grasses and legumes for forage. The potential for farm crops is good.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main limitation that affects use and management. Excessive water can be removed by open ditches, tile drains, surface drains, pumps, or a combination of these. If drained and otherwise well managed, the soil is suited to intensive row cropping. Minimum tillage and crop residue management improve and maintain tilth and organic-matter content.

This soil is well suited to grasses and legumes for hay or pasture. Drainage is necessary before high yields of forage or pasture plants can be obtained. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods reduce surface compaction and maintain good tilth and plant density.

This soil is well suited to water-tolerant trees and shrubs. The equipment limitation is severe. The soil is also severely limited by plant competition and windthrow. Seedlings survive and grow well, however, if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the slow permeability, a seasonal high water table, occasional flooding, and low strength adversely affect engineering uses of this soil. Limitations for building sites are severe. Artificial drainage is needed to keep wetness from becoming a problem. Dwellings and small buildings should be designed to prevent the structural damage caused by frost action and shrinking and swelling.

Limitations for local roads and streets are severe. They can be overcome by providing ditches along the roads to lower the water table. Lowering the water table also helps to prevent the damage caused by frost action. The base material for roads should be strengthened or replaced by more suitable material. Sanitary facilites should be connected to commercial sewers and treatment facilities. If facilities are not available, large absorption fields have been used to overcome the slow permeability of the soil and the water table has been lowered by a drainage system. Capability subclass IIw; woodland suitability subclass 2w.

RbA—Raub silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is in the broad uplands. Areas are generally irregularly shaped. They range from 3 to 60 acres in size and are dominantly about 25 acres.

In a typical profile, the surface layer is very dark brown silt loam about 13 inches thick. The subsoil is about 49 inches thick. It is, in sequence downward, about 5 inches of very dark grayish brown, firm silty clay loam; 19 inches of yellowish brown, mottled, firm silty clay loam; 17 inches of mottled yellowish brown and light brownish gray, firm clay loam; and 8 inches of light brownish gray, mottled, friable loam. The substratum to a depth of about 72 inches is yellowish brown, mottled, friable loam.

Included with this soil in mapping are areas of the very poorly drained Sable soils around drainageways; small, knoll-like areas of somewhat poorly drained Flanagan and Ipava soils; and areas of the moderately well drained Dana soils. Also included are a few areas of severely eroded soils and small depressional areas of soils that are wetter than this Raub soil.

Available water capacity is high, and permeability is slow. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for grasses and legumes for forage. The potential for farm crops is good.

If tiled, this soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops maintain organic-matter content and fertility and improve tilth.

If tiled, this soil is well suited to grasses and legumes for hay or pasture (fig. 10). Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

This soil formed under prairie, and no areas are in woodland. The suggestions in table 5 about trees to plant are based on observations of the growth of trees planted in the past.

High potential frost action, the slow permeability, wetness, and low strength affect engineering uses of this soil. The wetness severely limits most uses. An adequate drainage system in combination with storm sewers and foundation drains is needed to lower the water table.

Houses should be constructed without basements. Foundations and footings of other buildings should be designed to prevent the structural damage caused by shrinking and swelling and low strength. Adequate drainage and enlarged absorption fields are needed if septic tank absorption fields are to function properly. Capability subclass IIw; not assigned to a woodland suitability subclass.

ReA—Reesville silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on large and small flats in the uplands. Areas are generally broad and irregularly shaped. They range from 3 to 150 acres in size and are dominantly about 35 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray silt loam about 3 inches thick. The subsoil is mottled, firm silty clay loam about 26 inches thick; the upper 13 inches is light brownish gray, and the lower 13 inches is yellowish brown. The substratum to a depth of about 66 inches is yellowish brown and brown, mottled, friable silt loam and loam.

Included with this soil in mapping are a few small depressional areas of the wetter Ragsdale soils and small areas of wetter soils in narrow drainageways.

Available water capacity is high, and permeability is moderate or moderately slow. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is medium to slow. Reaction varies in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for grasses and legumes for forage, and a few are in woodland. The potential for farm crops is good.

If tiled, this soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops maintain organic-matter content and fertility and improve tilth.

If tiled, this soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

This soil is suited to water-tolerant hardwood trees. The equipment limitation is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation and by spraying, cutting, and girdling.

High potential frost action, the moderately slow to moderate permeability, wetness, and low strength adversely affect engineering uses of this soil. Wetness severely limits most uses. An adequate drainage system in combination with storm sewers and foundation drains is needed to lower water table.

Houses should be constructed without basements. Good road drainage ditches are needed to help reduce frost action. The low strength can be overcome if the soil is reinforced with more suitable base material. Adequate drainage is necessary if septic tank absorption fields are to function properly. Capability subclass IIw; woodland suitability subclass 3o.

RoF—Rodman gravelly loam, 25 to 50 percent slopes. This steep to very steep, excessively drained soil is on the sides of terraces. It is shallow over coarse sand and very gravelly coarse sand. Areas are long and narrow or irregularly shaped. They range from 3 to 70 acres in size and are dominantly about 20 acres.

In a typical profile, the surface layer is very dark grayish brown gravelly loam about 6 inches thick. The subsoil is dark brown, friable gravelly loam about 5 inches thick. The substratum to a depth of about 60 inches is yellowish brown coarse sand and very gravelly coarse sand.

Included with this soil in mapping are severely eroded areas.

Available water capacity is low, and permeability is very rapid. Organic-matter content is high. Surface runoff is slow to medium. Reaction is neutral in the surface layer.

This soil is in woodland. It is generally not suited to corn, soybeans, or small grain or to forage crops because slopes are very steep, available water capacity is low, and the hazard of erosion is severe. The potential for woodland is fair.

This soil is suited to trees. The equipment limitation is severe. The soil is also severely limited by seedling mortality and the hazard of erosion. Plant competition moderately limits growth of desirable trees. Competing vegetation can be controlled by site preparation and by spraying, cutting, and girdling.

The steep to very steep slopes, seepage, and the severe erosion hazard during construction adversely affect engineering uses of this soil. The seepage and the very steep slopes severely limit sanitary facilities and community development. An alternative site should be selected for most uses. Capability subclass VIIs; woodland suitability subclass 3s.

RtA—Rush silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on outwash terraces in the uplands. Areas are long and moderately wide or are irregularly shaped. They range from 4 to 40 acres in size and are dominantly about 20 acres.

In a typical profile, the surface layer is dark brown silt loam about 8 inches thick. The subsurface layer is dark brown silt loam about 3 inches thick. The subsoil is about 54 inches thick. The upper 23 inches of the subsoil is dark yellowish brown, firm silty clay loam; the next 6 inches is dark yellowish brown, firm clay loam; and the lower 25 inches is dark brown, firm sandy clay loam and gravelly clay loam. The substratum to a depth of about 72 inches is dark yellowish brown and light gray, loose sand and very gravelly sand.

Included with this soil in mapping are a few small areas of soils that have slopes of more than 2 percent, small areas of the wetter Starks soils in drainageways, and small areas along narrow bottom land where slopes are short and steep.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few are in woodland. The potential for cultivated crops is good.

This soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content and fertility and improve tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the moderate permeability, shrinking and swelling, low strength, and seepage adversely affect engineering uses of this soil. The shrink-swell potential and the low strength moderately limit building sites. Foundations and footings and basement walls should be properly designed to prevent the structural damage caused by shrinking and swelling and low strength.

Frost action and low strength severely limit local roads and streets on this soil. Good drainage ditches along roads reduce frost action. The soil should be reinforced with more suitable base material. Limitations for septic tank absorption fields are slight. Capability class I; woodland suitability subclass 1o.

RtB2—Rush silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on outwash terraces in the uplands. Areas are long and moderately wide or are irregularly shaped. They range from 5 to 50 acres in size and are dominantly about 25 acres.

In a typical profile, the surface layer is dark brown silt loam about 7 inches thick. The subsurface layer is dark brown silt loam about 3 inches thick. The subsoil is about 47 inches thick. It is, in sequence downward, about 22 inches of dark yellowish brown, firm silty clay loam; 5 inches of dark yellowish brown, firm clay loam; 16 inches of dark brown, firm sandy clay loam; and 4 inches of dark brown, firm gravelly clay loam. The substratum to a depth of about 65 inches is dark yellowish brown and light gray, single grained sand and very gravelly sand.

Included with this soil in mapping are a few small areas of soils that have slopes of more than 6 percent and areas where loess is less than 20 inches deep. Also included are areas along narrow bottom land where slopes are short and steep.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is moderate. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few are in woodland. The potential for farm crops is good.

This soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops help to control runoff, improve and maintain organic-matter content and fertility, and improve tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, increased runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the moderate permeability, the shrink-swell potential, low strength, and seepage adversely affect engineering uses of this soil. The shrink-swell potential and the low strength moderately limit building sites. Foundations and footings and basement walls should be properly designed to prevent the structural damage caused by shrinking and swelling and low strength.

Frost action and low strength severely limit local roads and streets on this soil. Good drainage ditches along roads reduce the frost action. The soil should be reinforced with more suitable base material. Limitations for septic tank absorption fields are slight. Capability subclass IIe; woodland suitability subclass 1o.

RuB2—Russell silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on broad ridgetops, side slopes, and toe slopes in the uplands. Areas are broad and irregularly shaped. They range from 3 to 50 acres in size and are dominantly about 15 acres.

In a typical profile, the surface layer is dark brown silt loam about 7 inches thick. The subsoil is about 48 inches thick. The upper 23 inches of the subsoil is yellowish brown, firm silty clay loam; and the lower 25 inches is yellowish brown or dark yellowish brown, firm clay loam. The substratum to a depth of about 72 inches is yellowish brown, friable loam.

Included with this soil in mapping are small areas of severely eroded soils, a few small areas of the wetter Fincastle and Xenia soils in slight depressions, and small areas of Russell soils that have slopes of more than 6 percent.

Available water capacity is high. Permeability is moderate in the solum and moderately slow in the substratum. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farm crops is fair to good.

This soil is well suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling water erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

Moderate potential frost action, the shrink-swell potential, low strength, the moderate permeability in the subsoil and moderately slow permeability in the substratum, and a severe hazard of erosion during construction adversely affect engineering uses of this soil. The shrink-swell potential, the low strength, and the slope moderately limit buildings. Foundations and footings and basement walls should be properly designed to prevent the structural damage caused by shrinking and swelling and low strength.

Frost action and low strength severely limit local roads and streets on this soil. Good drainage ditches along roads reduce frost action. The soil should be reinforced with more suitable base material. The slope and the slow absorption of liquid waste moderately limit septic tank absorption fields. These limitations can be partly overcome by building the absorption field on the contour and by enlarging the filter field. All disturbed areas should be smoothed and planted as soon as possible to reduce the risk of erosion. Capability subclass IIe; woodland suitability subclass 1o.

RuC2—Russell silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on ridgetops and side slopes adjacent to drainageways in the uplands. Areas are long and narrow. They range from 3 to 26 acres in size and are dominantly about 8 acres.

In a typical profile, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is about 44 inches thick. The upper 9 inches of the subsoil is dark brown, firm silty clay loam; the next 25 inches is dark yellowish brown, firm clay loam; and the lower 10 inches is yellowish brown, firm clay loam. The substratum to a depth of about 62 inches is brown, friable loam.

Included with this soil in mapping are a few small areas of severely eroded soils and a few areas where slopes are more than 12 percent. Also included are some areas of the wetter Xenia soils.

Available water capacity is high. Permeability is moderate in the solum and moderately slow in the substratum. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Some areas are farmed. Some areas are used for corn, soybeans, or small grain or for hay and pasture. A few areas support hardwoods. The potential for farm crops is fair.

This soil is suited to corn, soybeans, and small grain. If the soil is used for cultivated crops, the hazard of erosion is severe. One or more conservation measures, such as crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures, are needed to prevent excessive soil loss. Returning crop residue to the soil and planting cover crops help to reduce runoff, control erosion, and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling water erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

Potential frost action, the shrink-swell potential, low strength, the moderate permeability in subsoil and moderately slow permeability in the substratum, and a severe hazard of erosion during construction adversely affect engineering uses of this soil. The shrink-swell potential and the slope moderately to severely limit building sites. Foundations and footings and basement walls should be properly designed to prevent the structural damage caused by shrinking and swelling.

Frost action and low strength severely limit local roads and streets on this soil. Good drainage ditches along roads reduce the frost action. The soil should be reinforced with more suitable base material. The slope and the slow absorption of liquid waste moderately limit septic tank absorption fields. These limitations can be partly overcome by building the absorption field on the contour and by enlarging the filter field. All disturbed areas should be smoothed and planted as soon as possible to reduce the risk of erosion. Capability subclass IIIe; woodland suitability subclass 1o.

Sa—Sable silty clay loam. This nearly level to slightly depressional, deep, poorly drained soil is on uplands. Areas are generally broad and irregularly shaped. They range from 3 to 450 acres in size and are dominantly about 200 acres.

In a typical profile, the surface layer is black silty clay loam about 19 inches thick. The subsoil is mottled, firm silty clay loam about 35 inches thick; the upper 13 inches is gray, and the lower 22 inches is light gray. The upper 8 inches of the substratum is light gray, mottled, friable silt loam; below this, to a depth of 72 inches, it is light gray, loose, stratified fine sand and coarse sand with traces of fine gravel.

Included with this soil in mapping are a few small areas of poorly drained soils that have a silt loam surface layer; the entire subsoil and the substratum of these soils formed in deep silt. Also included are a few small areas of the somewhat poorly drained Ipava soils and the well drained Tama soils in the higher positions on the landscape.

Available water capacity is very high, and permeability is moderate. Organic-matter content is high in the surface layer. Surface runoff is ponded or slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, or small grain or for grasses and legumes for forage. This soil formed under prairie, and no areas are in woodland. The potential for cultivated crops is good.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main limitation that affects use and management. Excessive water can be removed by open ditches, tile drains, surface drains, pumps, or a combination of these. If drained and otherwise well managed, the soil is suited to intensive row cropping. Minimum tillage and crop residue management improve and maintain tilth and organic-matter content.

This soil is well suited to grasses and legumes for hay or pasture. Drainage is necessary to obtain high yields of forage or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods reduce surface compaction and maintain good tilth and plant density.

High potential frost action, the moderate permeability, a seasonal high water table, occasional flooding, and low strength adversely affect engineering uses of this soil. Limitations for building sites are severe. Artificial drainage is needed to keep wetness from becoming a problem. Dwellings and small buildings should be constructed without basements, and foundations and footings should be designed to prevent the structural damage caused by frost action and by shrinking and swelling.

Limitations for local roads and streets are severe. They can be overcome by providing ditches along the roads to lower the water table and to help prevent damage caused by frost action. The base material for roads should be strengthened, or the soil should be replaced by more suitable material. Sanitary facilities should be connected to commercial sewers and treatment facilities. If facilities are not available, large absorption fields can be used to overcome the slow permeability of the soil and the water table has been lowered by a drainage system. Capability subclass IIw; not assigned to a woodland suitability subclass.

Sb—Sable silty clay loam, loamy till substratum. This nearly level, deep, poorly drained soil occupies slightly depressional areas in the uplands. Areas are generally broad and irregularly shaped. They range from 3 to 450 acres in size and are dominantly about 200 acres.

In a typical profile, the surface layer is black silty clay loam about 15 inches thick. The subsoil is mottled, firm silty clay loam about 39 inches thick; the upper 15 inches is light brownish gray, and the lower 24 inches is light gray. The substratum to a depth of about 72 inches is gray, mottled, friable loam till.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Flanagan and Raub soils in the higher positions on the landscape.

Available water capacity is very high, and permeability is moderate. Organic-matter content is high in the surface layer. Surface runoff is ponded or slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, or small grains or for grasses and legumes for forage. This soil formed under prairie, and no areas are in woodland. The potential for farming is good.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Wetness is the main limitation that affects use and management. Excessive water can be removed by open ditches, tile drains, surface drains, pumps, or a combination of these. If drained and otherwise well managed, the soil is suited to intensive row cropping. Minimum tillage and crop residue management improve and maintain tilth and organic-matter content.

This soil is well suited to grasses and legumes for hay or pasture. Drainage is necessary to obtain high yields of forage or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods reduce surface compaction and maintain good tilth and plant density.

High potential frost action, the moderate permeability, a seasonal high water table, occasional flooding, and low strength adversely affect engineering uses of this soil. Limitations for building sites are severe. Artificial drainage is needed to keep wetness from becoming a problem. Dwellings and small buildings should be constructed without basements, and foundations and footings should be designed to prevent the structural damage caused by frost action and shrinking and swelling.

Limitations for local roads and streets are severe. They can be overcome by providing ditches along the road to lower the water table and to help prevent the damage caused by frost action. The base material for roads should be strengthened, or the soil should be replaced by more suitable material. Sanitary facilities should be connected to commercial sewers and treatment facilities. If facilities are not available, large absorption fields can be used to overcome the slow permeability of the soil if the water table has been lowered by a drainage system. Capability subclass IIw; not assigned to a woodland suitability subclass.

SeA—Shadeland silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on narrow terraces. It is moderately deep over bedrock. Areas are generally irregularly shaped or long and narrow. They range from 3 to 40 acres in size and are dominantly about 8 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 4 inches thick. The subsoil is about 19 inches thick. The upper 5 inches of the subsoil is light brownish gray, mottled, firm silty clay loam; the next 6 inches is yellowish brown, mottled, firm clay loam; and the lower 8 inches is light brownish gray, mottled, firm silty clay loam. The substratum, to a depth of about 35 inches, is light brownish gray very shaly clay loam. Hard sandstone is at a depth of 35 inches.

Included with this soil in mapping are a few small areas of High Gap and Whitaker soils. Also included are a few small areas where the surface layer is sand or gravelly sand.

Available water capacity is moderate, and permeability is moderately slow. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are used for corn, soybeans, and small grain. Some areas are used for hay and pasture, and a few support hardwoods. The potential for farm crops is fair.

If tiled, this soil is well suited to corn, soybeans, and small grain. The sandstone bedrock interferes with subsurface tile outlets. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content and fertility and improve tilth.

If tiled, this soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to water-tolerant trees. Plant competition slightly limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying or girdling.

Wetness, high potential frost action, low strength, the moderate permeability, and the moderate depth to bedrock adversely affect engineering uses of this soil. The wetness and the depth to rock severely limit buildings or sanitary facilities. Adequate drainage is difficult to install. Frost action and low strength severely limit local roads and streets on this soil. The base material for roads should be strengthened. Capability subclass IIIw; woodland suitability subclass 3o.

SgA—Shipshe loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad terraces. It is moderately deep over coarse sand and gravel. Areas are wide and irregularly shaped. They range from 5 to 500 acres in size and are dominantly about 225 acres.

In a typical profile, the surface layer is very dark brown loam about 14 inches thick. The subsoil is about 24 inches thick. It is, in sequence downward, about 6 inches of dark brown, friable very gravelly loam; 10 inches of dark reddish brown, firm very gravelly clay loam; 6 inches of dark yellowish brown, firm very gravelly clay loam; and 2 inches of very dark grayish brown, firm very gravelly clay loam. The substratum to a depth of about 60 inches is brown, stratified very gravelly coarse sand and coarse sand. In places the surface layer is gravelly or sandy.

Included with this soil in mapping are small areas of deep, well drained soils in slight depressions and narrow drainageways.

Available water capacity is low. Permeability is moderate or moderately rapid in the solum and very rapid in the substratum. Organic-matter content is high in the surface layer. Surface runoff is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, small grain, grain sorghum, or grasses and legumes. This soil formed under prairie, and no areas are in woodland. The potential for farm crops is fair.

This soil is well suited to corn, soybeans, and small grain. Droughtiness is a problem in most growing seasons. The soil is also suited to irrigated vegetable crops, such as potatoes, tomatoes, and green beans. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content, conserve moisture and fertility, and improve tilth.

This soil is well suited to grasses and legumes for hay and pasture (fig. 11). If the pasture is overgrazed or grazed when the soil is too dry, plants die out. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

Seepage and frost action adversely affect engineering uses of this soil. Limitations for buildings sites and septic tank absorption fields are slight. Frost action moderately limits local road and streets on this soil. This limitation can be overcome by good drainage ditches. Capability subclass IIIs; not assigned to a woodland suitability subclass.

SgB—Shipshe loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on broad terraces. It is moderately deep over coarse sand and gravel. Areas generally range from 3 to 20 acres in size; they are dominantly about 10 acres.

In a typical profile, the surface layer is very dark brown loam about 12 inches thick. The subsoil is about 21 inches thick. It is, in sequence downward, about 5 inches of dark brown, friable very gravelly loam; 9 inches of dark reddish brown, firm very gravelly clay loam; 5 inches of dark yellowish brown, firm very gravelly clay loam; and 2 inches of very dark grayish brown, firm very gravelly clay loam. The substratum to a depth of about 55 inches is brown, stratified very gravelly coarse sand and coarse sand.

Included with this soil in mapping are small areas of deep, well drained soils in slight depressions and narrow drainageways and areas where slopes are more than 6 percent. Also included are few areas where the surface layer is gravelly or sandy.

Available water capacity is low, and permeability is moderate or moderately rapid in the solum and very rapid in the substratum. Organic-matter content is high in the surface layer. Surface runoff is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, small grain, grain sorghum, or grasses and legumes. This soil formed under prairie, and no areas are wooded. The potential for farm crops is fair.

This soil is well suited to corn, soybeans, and small grain. It is suited to irrigated vegetable crops, such as potatoes, tomatoes, and green beans. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Droughtiness is a problem during most growing seasons.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling water erosion. If the pasture is overgrazed or grazed when the soil is too dry, plants die out. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

Seepage and frost action adversely affect engineering uses of this soil. Limitations for building sites and septic tank absorption fields are slight. Frost action moderately limits local road and streets on this soil. This limitation can be overcome by good drainage ditches. Capability subclass IIIe; not assigned to a woodland suitability subclass.

Sh—Shoals silt loam. This nearly level, deep, somewhat poorly drained soil is on bottom land along the major streams and narrow streams, in narrow draws, and on toe slopes. It is subject to flooding. Areas are generally long and narrow or irregularly shaped. They range from 4 to 50 acres in size and are dominantly about 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The underlying material is, in sequence downward, about 6 inches of dark brown, mottled, friable silt loam; 22 inches of grayish brown, mottled, friable loam; 24 inches of light brownish gray, mottled, friable loam; and 12 inches of grayish brown, mottled, friable, stratified silt loam, loam, and sandy loam.

Included with this soil in mapping are a few small depressional areas of the wetter Sloan soil and the moderately well drained Eel soil.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate. Surface runoff from cultivated areas is very slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few are in woodland. The potential for farm crops is fair. Flooding often limits crop production.

This soil is well suited to corn, soybeans, small grain, and grasses and legumes if it is adequately protected against flooding. Conservation practices are needed if crops are grown. If levees are built and artificial drainage ditches and tile drains are used, a conservation cropping system in which row crops are grown during most years is suitable. Minimum tillage, winter cover crops, and crop residue management maintain and improve organic-matter content and maintain good tilth.

This soil is well suited to grasses and legumes for forage. If the soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is too wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to water-tolerant trees. The equipment limitation is slight. Plant competition severely limits growth of desirable trees. Unwanted trees and shrubs, however, can be removed or controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the moderate permeability, and a severe flood hazard adversely affect engineering uses of this soil. Wetness and flooding severely limit buildings, local roads and streets, and septic tank absorption fields. A soil that has better potential for these uses should be considered. Capability subclass IIw; woodland suitability subclass 2o.

Sm—Sleeth silt loam. This nearly level, deep, somewhat poorly drained soil is on broad terraces. Areas are generally irregularly shaped. They are 3 to 7 acres in size and are dominantly about 5 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is grayish brown, mottled silt loam about 4 inches thick. The subsoil is about 37 inches thick. The upper 6 inches of the subsoil is grayish brown, mottled, firm clay loam; the next 17 inches is yellowish brown, mottled, firm clay loam; and the lower 14 inches is dark grayish brown, mottled, firm gravelly clay loam. The substratum to a depth of about 60 inches is brown, loose sand and very gravelly sand.

Included with this soil in mapping are small areas of Westland soils. Also included are small areas, in depressions, of soils that are wetter than this Sleeth soil.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farm crops is fair.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content and fertility and improve tilth.

If adequately drained, this soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to water-tolerant trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the moderate permeability, wetness, seepage, and low strength adversely affect engineering uses of this soil. The wetness severely limits building sites. An adequate drainage system in combination with storm sewers and foundation drains is needed to lower the water table. Houses should be constructed without basements.

Frost action and low strength severely limit local roads and streets on this soil. Good drainage ditches along roads are needed to reduce frost action. The soil should be reinforced with more suitable base material. Adequate drainage is necessary if septic tank absorption fields are to function properly. Capability subclass IIIw; woodland suitability subclass 3o.

Sn—Sloan loam. This nearly level or slightly depressional, deep, very poorly drained soil is on bottom land along the major streams and narrow streams, in narrow draws, and on toe slopes. It is subject to frequent flooding. Areas are generally long and narrow or irregularly shaped. They are 3 to 10 acres in size and are dominantly about 5 acres.

In a typical profile, the surface layer is about 15 inches thick. The upper 3 inches is very dark gray loam, and the lower 12 inches is very dark grayish brown loam. The subsoil is about 30 inches thick. The upper 14 inches of the subsoil is dark gray, mottled, friable silt loam; and the lower 16 inches is dark gray, mottled, friable loam. The substratum to a depth of about 60 inches is grayish brown, friable, stratified sandy loam and loam.

Included with this soil in mapping are small areas of the less wet Shoals and Eel soils.

Available water capacity is high, and permeability is moderate. Organic-matter content is high. Surface runoff from cultivated areas is very slow to ponded. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Some areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and some are in woodland. The potential for farming is fair. Flooding often limits production of crops.

This soil is well suited to corn, soybeans, small grain, and grasses and legumes if it is adequately protected against flooding. Conservation practices are needed if crops are grown. If levees are built and artificial drainage ditches and tile drains are used, a conservation cropping system in which row crops are grown during most years is suitable. Minimum tillage, winter cover crops, and crop residue management maintain and improve organic-matter content and maintain good tilth.

This soil is well suited to grasses and legumes for forage. If the soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is too wet. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to water-tolerant trees. It is severely limited by seedling mortality and the hazard of windthrow. Also, the equipment limitation is severe. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, the moderate permeability, and a severe flood hazard adversely affect engineering uses of this soil. Wetness and flooding severely limit buildings, local roads and streets, and septic tank absorption fields. Alternative sites that are not flooded should be selected for these uses. Capability subclass IIIw; woodland suitability subclass 2w.

So—Starks silt loam. This nearly level, somewhat poorly drained soil is on outwash plains in the uplands. Areas are broad and irregularly shaped. They range from 3 to 50 acres and are dominantly about 20 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark brown silt loam about 4 inches thick. The subsoil is about 50 inches thick. The upper 12 inches of the subsoil is dark brown, mottled, firm silty clay loam; the next 14 inches is grayish brown, mottled, firm silty clay loam; and the lower 24 inches is grayish brown, mottled, firm sandy clay loam. The substratum to a depth of about 72 inches is dark brown, very friable loamy sand.

Included with this soil in mapping are a few small areas of Fincastle and Ragsdale soils. Also included are some small areas where loess is more than 40 inches deep.

Available water capacity is high, and permeability is moderate to moderately slow. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay and pasture, and a few support hardwoods. The potential for farm crops is good.

If adequately drained, this soil is suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops maintain organic-matter content and fertility and improve tilth.

If adequately drained, this soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

This soil is suited to water-tolerant hardwoods. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation and by spraying and girdling.

High potential frost action, seepage, the moderate to moderately slow permeability, and a seasonal high water table adversely affect engineering uses of this soil. Wetness severely limits building sites. An adequate drainage system in combination with storm sewers and foundation drains is needed to lower the water table. Houses should be constructed without basements.

Frost action and low strength severely limit local roads and streets on this soil. Good drainage ditches along roads are needed to reduce frost action. The soil should be reinforced with more suitable base material. Adequate drainage and enlarged absorption fields are needed before septic tank absorption fields can function properly. Capability subclass IIw; woodland suitability subclass 2o.

Sp—Stonelick sandy loam. This nearly level, deep, well drained soil is on bottom land. It is subject to flooding. Areas are long and wide and irregularly shaped. They range from 5 to 50 acres in size and are dominantly about 15 acres.

In a typical profile, the surface layer is dark brown sandy loam about 10 inches thick. The underlying material is, in sequence downward, 12 inches of yellowish brown, very friable loamy sand; 15 inches of dark brown, very friable sandy loam; 17 inches of dark yellowish brown, very friable loamy sand; and 18 inches of dark brown, loose fine sandy loam.

Included with this soil in mapping are small areas of Genesee soils in the slightly lower positions on the landscape. These soils are less sandy throughout than this Stonelick soil. Also included are small depressional areas of the wetter Eel soils, which are farther away from streams than is this Stonelick soil.

Available water capacity is moderate, and permeability is moderately rapid. Organic-matter content is moderate in the surface layer. Surface runoff is slow.

This soil is well suited to corn, soybeans, and grain sorghum if it is adequately protected against flooding. Conservation practices are needed if crops are grown. If levees and adequate diversion terraces are built and maintained, a conservation cropping system in which row crops are grown during most years is suitable. Minimum tillage, winter cover crops, and crop residue management maintain and improve organic-matter content and maintain good tilth.

This soil is well suited to grasses and legumes for forage. If the soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is too dry. If the pasture is grazed when the soil is dry, the plants die out. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and the soil in good condition.

This soil is well suited to trees, but few areas are used for trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be removed or controlled by site preparation or by spraying, cutting, or girdling.

A severe flood hazard and the rapid absorption of liquid waste adversely affect engineering uses of this soil. Flooding severely limits buildings, local roads and streets, sanitary landfills, sewage lagoons, and septic tank absorption fields. A soil that has better potential for these uses should be selected. Capability subclass IIs; woodland suitability subclass 2o.

TaB—Tama silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on knolls and on side slopes in the uplands. Areas are on islandlike knolls that are slightly elevated above the surrounding wetter soils, or they are long and narrow or irregularly shaped. They range from 2 to 20 acres in size and are dominantly about 10 acres.

In a typical profile, the surface layer is very dark brown silt loam about 15 inches thick. The subsoil is about 40 inches thick. The upper 4 inches of the subsoil is dark brown, friable silt loam; the next 19 inches is brown, firm silty clay loam; and the lower 17 inches is pale brown, friable silt loam. The substratum to a depth of about 72 inches is yellowish brown, friable silt loam.

Included with this soil in mapping are areas of a similar soil that is mottled in the lower part of the subsoil, areas of the somewhat poorly drained Ipava soils or very poorly drained Ragsdale soils in slight depressions and narrow drainageways, and a few small areas where slopes are less than 2 percent. Also included are severely eroded spots.

Available water capacity is very high, and permeability is moderate. Organic-matter content is high in the surface layer. Surface runoff from cultivated areas is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture. This soil formed under prairie, and no areas are in woodland. The potential for the farm crops is good.

This soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content and fertility, reduce the erosion hazard, and improve tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

Moderate potential frost action, slope, the moderate permeability, the shrink-swell potential, and low strength adversely affect engineering uses of this soil. The shrink-swell potential, the low strength, and the slope moderately limit building sites. Foundations and footings and basement walls should be properly designed to prevent the structural damage caused by shrinking and swelling and low strength.

Frost action and low strength severely limit local roads and streets on this soil. Good drainage ditches along roads reduce frost action. The soil should be reinforced with more suitable base material. The slope and the slow absorption of liquid waste moderately limit septic tank absorption fields. These limitations can be partly overcome by building the absorption field on the contour and by enlarging the filter field. All disturbed areas should be smoothed and planted as soon as possible to reduce the risk of erosion. Capability subclass IIe; not assigned to a woodland suitability subclass.

WeA—Wea silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on outwash plains or terraces. Areas are long and narrow or irregularly shaped. They range from 3 to 50 acres in size and are dominantly about 20 acres.

In a typical profile, the surface layer is very dark brown silt loam about 16 inches thick. The subsoil is 43 inches thick. The upper 12 inches of the subsoil is very dark grayish brown and dark brown, firm clay loam; and the lower 31 inches is dark brown, firm gravelly clay loam and very gravelly clay loam. The substratum to a depth of about 72 inches is brown and yellowish brown, loose sand and very gravelly sand.

Included with this soil in mapping are small areas of the well drained Shipshe soils. Also included are a few gravel spots and sand spots.

Available water capacity and permeability are moderate. Organic-matter content is high in the surface layer. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for hay or pasture. Some areas are used for corn, soybeans, and small grain. This soil formed under prairie, and no areas are in woodland. The potential for farm crops is good.

This soil is suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content and fertility and improve tilth.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

The moderate permeability, moderate potential frost action, and seepage in the lower part of the subsoil adversely affect engineering uses of this soil. The shrink-swell potential and low strength moderately limit building sites. Foundations and footings should be designed to prevent the structural damage caused by shrinking and swelling and low strength.

The low strength severely limits local roads and streets on this soil. The base material should be strengthened with more suitable material. Limitations for septic tank absorption fields are slight. Capability class I; not assigned to a woodland suitability subclass.

Wt—Westland silty clay loam. This nearly level, deep, very poorly drained soil is in slight depressions on terraces. Areas are long and narrow or irregularly shaped. They range from 3 to 20 acres in size and are dominantly about 10 acres.

In a typical profile, the surface layer is very dark brown silty clay loam about 14 inches thick. The subsoil is about 30 inches thick. The upper 4 inches of the subsoil is dark grayish brown, mottled, firm clay loam; the next 6 inches is mottled dark grayish brown and light olive brown, firm gravelly clay loam; and the lower 20 inches is very dark grayish brown, mottled, firm gravelly clay loam. The substratum to a depth of about 60 inches is mottled very dark grayish brown, grayish brown, and very dark gray, loose coarse sand and very gravelly coarse sand.

Included with this soil in mapping are small areas of similar soils that have a silt loam or clay loam surface layer. Also included are small areas of soils, in depressions, that have a mucky surface layer.

Available water capacity is high, and permeability is slow. Organic-matter content is high in the surface layer. Surface runoff from cultivated areas is slow or ponded. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farm crops is good if this soil is adequately drained.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter crops improve and maintain organic-matter content and fertility and improve tilth.

If adequately drained, this soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture in good condition.

This soil is well suited to water-tolerant trees. It is severely limited by seedling mortality, the windthrow hazard, and plant competition. Also, the equipment limitation is severe. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

High potential frost action, wetness, flooding, and low strength adversely affect engineering uses of this soil. The wetness and the flooding severely limit local roads and streets, small commercial buildings, and dwellings with or without basements. Artificial drainage is needed to keep wetness from becoming a problem. Dwellings and small buildings should be constructed without basements. Drainage ditches along local roads lower the water table and help to prevent the damage caused by frost action. The base material for roads should be strengthened or replaced by more suitable material.

The wetness severely limits septic tank absorption fields. This limitation can be partly overcome by enlarging the absorption field and by lowering the water table. Commercial sewer systems are generally needed. Capability subclass IIw; woodland suitability subclass 2w.

Wx—Whitaker silt loam. This nearly level, somewhat poorly drained soil is on broad terraces. Areas are long and wide or irregularly shaped. They range from 3 to 50 acres in size and are dominantly about 20 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is grayish brown, mottled silt loam about 4 inches thick. The subsoil is about 41 inches thick. It is, in sequence downward, about 4 inches of brown, mottled, friable silty clay loam; 7 inches of yellowish brown, mottled, firm clay loam; 13 inches of light brownish gray, mottled, firm clay loam; and 17 inches of brown, mottled, friable loam. The substratum to a depth of about 72 inches is dark grayish brown, mottled, stratified silt loam and sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth soils. Also included are some areas of soils, in depressions, that are wetter than this Whitaker soil.

Available water capacity is high, and permeability is moderate. Organic-matter content is moderate. Surface runoff from cultivated areas is slow. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farm crops is good if this soil is adequately drained.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. Minimum tillage, crop residue management, and winter cover crops improve and maintain organic-matter content and fertility and improve tilth.

If adequately drained, this soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to water-tolerant trees. Plant competition moderately limits growth of desirable trees. The equipment limitation is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation and by spraying, cutting, or girdling.

High potential frost action, the rapid absorption of liquid waste in the substratum, the moderate permeability, and the wetness caused by a seasonal high water table adversely affect engineering uses of this soil. The wetness severely limits building sites. An adequate drainage system in combination with storm sewers and foundation drains is needed to lower the water table. Houses should be constructed without basements.

Frost action and low strength severely limit local roads and streets on this soil. Good drainage ditches along roads reduce frost action. The soil should be reinforced with more suitable base material. Adequate drainage is necessary before septic tank absorption fields can function properly. Capability class I; woodland suitability subclass 3o.

XeB—Xenia silt loam, 1 to 4 percent slopes. This nearly level and gently sloping, moderately well drained soil is on uplands. Areas are generally long and narrow or irregularly shaped. They range from 3 to 35 acres in size and are dominantly about 10 acres.

In a typical profile, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsurface layer is dark brown silt loam about 4 inches thick. The subsoil is about 40 inches thick. The upper 6 inches of the subsoil is yellowish brown and pale brown, firm silty clay loam; the next 10 inches is yellowish brown, mottled, firm silty clay loam; and the lower 24 inches is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 72 inches is brown, mottled loam.

Included with this soil in mapping are a few areas of the somewhat poorly drained Fincastle soils and the very poorly drained Ragsdale soils. Also included are a few small eroded areas.

Available water capacity is high, and permeability is moderately slow. Organic-matter content is moderate in the surface layer. Surface runoff from cultivated areas is medium. Reaction varies widely in the surface layer as a result of local liming practices.

Most areas are farmed. Many areas are used for corn, soybeans, and small grain. Some areas are used for hay or pasture, and a few support hardwoods. The potential for farm crops is good.

This soil is well suited to corn, soybeans, and small grain. Erosion control is needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Crop residue management and cover crops help to control erosion and improve and maintain tilth and organic-matter content.

The use of this soil for grasses and legumes for hay or pasture is also effective in controlling water erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to trees. Plant competition moderately limits growth of desirable trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

The moderately slow permeability, wetness, the shrink-swell potential, low strength, and frost action adversely affect engineering uses of this soil. Limitations for building sites are moderate. Houses should be constructed without basements. Properly designing foundations and footings and installing foundation drain tile help to prevent the structural damage caused by shrinking and swelling and low strength.

The wetness severely limits septic tank absorption fields. This limitation can be partly overcome by lowering the water table and enlarging the filter field. The frost action and the low strength severely limit local roads and streets on the soil. Adequate road ditches are generally needed. The base material generally should be strengthened. Capability subclass IIe; woodland suitability subclass 1o.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

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

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

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

Crops and pasture

MAC H. ROBARDS, soil scientist, and DAVID HUGHES, district conservationist, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 118,888 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory (*3*). Of this total, 78,675 acres was used for row crops, mainly corn and and soybeans; 9,017 acres for close-grown crops, mainly wheat; 5,410 acres for rotation hay and pasture; and 13,162 acres for permanent pasture.

The potential of the soils in Vermillion County for increased production of food is good. Applying the latest crop production technology to all cropland in the county would increase food production significantly. This soil survey can greatly facilitate the application of such technology.

The acreage in crops and pasture has very slowly been decreasing as some areas have been developed for urban uses. In 1967, an estimated 13,207 acres of the county was urban and built-up land. The acreage under urban development has been growing at the rate of about 56 acres per year. The use of this soil survey to help make land-use decisions that will influence the future role of farming in the county is described in the section "General soil map for broad land-use planning."

Soil erosion is the major soil problem on about 52 percent of the cropland and pasture in Vermillion County. If the slope is more than 2 percent, erosion is a hazard. Alford, Dana, Fox, High Gap, Martinsville, Ockley, Russell, and Xenia soils, for example, have slopes of more than 2 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, 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 with a clayey subsoil and with slopes of more than 2 percent, such as Fox, Martinsville, Ockley, and Russell soils, and on soils with a layer in or below the subsoil that limits the depth of the root zone. Such layers include the sandstone and shale underlying High Gap soils. Erosion also reduces the productivity on soils that tend to be droughty, such as Elston, Fox, and Shipshe soils. Second, erosion on farmland results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

In clayey or hardpan spots in many sloping fields, preparing a good seedbed and tilling are difficult because the original friable surface layer has been eroded away. Such spots of moderately eroded Fox and Russell soils are common.

Erosion control provides protective cover, reduces runoff, and increases infiltration. A cropping system that keeps crop residue and plant cover on the soil during the rainy season can hold soil erosion losses to an amount that will not reduce the productive capacity of the soil. On livestock farms, which require pasture and hay, legume and grass forage crops in the cropping system reduce the risk of erosion on sloping soils and provide nitrogen and improve tilth for the following crop.

In some areas of the moderately sloping Fox and Miami soils, slopes are so short and irregular that contour tillage or terracing is not practical. On these soils, a cropping system that provides substantial plant cover is needed to control erosion unless minimum tillage is practiced. Minimum tillage and crop residue on the surface increase the infiltration rate and reduce the hazards of runoff and erosion. They can be adapted to most soils in the survey area but are less successful on the severely eroded soils that have a clayey surface layer, such as Fox and Miami soils.

Terraces and diversions reduce the length of slopes and reduce runoff and the risk of erosion. They are most practical on deep, well drained soils that have regular slopes. Tama soils and some Martinsville soils are suitable for terraces. Other soils are less suitable for terraces and diversions because of irregular slopes; excessive wetness in the terrace channels; or a clayey subsoil, which would be exposed in terrace channels. High Gap soils are less suitable because bedrock is less than 40 inches below the surface.

Contouring and contour stripcropping are widely needed erosion-control practices in the survey area. They are best adapted to soils with smooth, uniform slopes, including most areas of the sloping Alford, Dana, Elston, Fox, High Gap, Martinsville, Ockley, Proctor, Rush, Russell, Tama, and Xenia soils.

Soil blowing is a hazard on the sandy Elston and Princeton soils and on Palms muck. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover or surface mulch or keeping the surface rough through proper tillage minimizes soil blowing on these soils. Windbreaks of suitable shrubs, such as Tatarian honeysuckle or autumn-olive, are effective in reducing soil blowing on Palms muck.

Assistance in designing erosion-control measures suited to each kind of soil is available from the local Soil Conservation Service office.

Soil drainage is the major management need on about 14 percent of the acreage used for crops and pasture in the survey area. Some soils are naturally so wet that the production of crops common to the area is generally not possible. These are the very poorly drained Sable, Ragsdale, Sloan, and Westland soils, which make up about 27,218 acres of the survey area, and Palms muck, which makes up about 224 acres.

Unless artificially drained, the somewhat poorly drained soils in the county are so wet that crops are damaged during most years. Flanagan, Fincastle, Ipava, Raub, Reesville, Shadeland, Shoals, Sleeth, Starks, and Whitaker soils, which make up about 40,251 acres, are somewhat poorly drained.

Small areas of the wetter soils along drainageways and in swales are commonly included in areas of the moderately well drained Dana and Xenia soils, especially those that have slopes of 1 to 4 percent. Artificial drainage is needed in some of these wetter areas.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed in most areas of the poorly drained and very poorly drained soils used for intensive row cropping. Drains should be more closely spaced in slowly permeable soils than in the more permeable soils. Tile drainage is slow in Raub soils and moderately slow in Fincastle, Ipava, Reesville, and Starks soils. Finding adequate outlets for tile drainage systems is difficult in many areas of Sable, Ragsdale, Sloan, and Westland soils.

Organic soils oxidize and subside when the pore space is filled with air. Therefore, special drainage systems are needed to control the depth and the period of drainage. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of organic soils. Information on the design of drainage systems for each kind of soil is contained in the Technical Guide, which is available in local offices of the Soil Conservation Service.

Soil fertility is naturally medium in most soils of the uplands. All soils in Vermillion County are naturally acid unless limed. The soils on flood plains, such as Armiesburg, Eel, Genesee, Shoals, and Sloan soils, are slightly acid to neutral or mildly alkaline. They have a naturally higher content of plant nutrients than most upland soils.

Many upland soils are naturally strongly acid. If these soils have never been limed, applications of ground limestone are needed to raise the pH level sufficiently for good growth of alfalfa and other crops that grow only on nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

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

Most of the soils used for crops in the survey area have a silt loam surface layer that is light in color and moderate in content of organic matter. Generally, the structure of such soils is weak, and a crust forms on the surface after intense rainfall. When dry, the crust is hard and nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can improve soil structure and reduce crust formation.

On the dark and light colored soils that have a silt loam surface layer, a crust forms in winter and spring. As a result, fall plowing is generally not desirable. Many of these soils are nearly as dense and hard at planting time after fall plowing as they were before they were plowed. Also, about 30 percent of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in the fall.

The dark colored Sable and Westland soils are clayey, and poor tilth is a problem because the soils commonly stay wet until late in spring. If plowed when wet, they tend to be very cloddy when dry, so a good seedbed is difficult to prepare. Fall plowing generally results in good tilth in the spring.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. The row crops are corn and, to an increasing extent, soybeans. Grain sorghum can be grown.

Wheat is the most common close-growing crop. Oats, rye, and barley can be grown. Grass seed can be produced from bromegrass, fescue, redtop, and bluegrass.

Special crops grown commercially in the survey area are vegetables, small fruits, and tree fruits. A small acreage throughout the county is used for strawberries, sweet corn, tomatoes, and small fruits.

Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables and small fruits. In this survey area these are the Genesee, Martinsville, Ockley, Rush, and Wea soils that have slopes of less than 6 percent. They make up a total of about 18,500 acres. If irrigated, about 18,300 acres of the Elston, Fox, Shipshe, and Stonelick soils that have slopes of less than 6 percent are very well suited to vegetables and small fruits. Crops can generally be planted and harvested earlier on all these soils than on the other soils in the survey area.

If adequately drained, the mucks in the county are well suited to a wide range of vegetable crops. Palms muck makes up about 224 acres of the county.

Most of the well drained soils in the survey area are suitable for orchards 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 and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

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 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

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

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

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

In Vermillion County, all kinds of soil are grouped at two levels: capability class and subclass. The capability class and subclass are defined in the following paragraphs. A survey area may not have soils of all classes.

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 landforms have limitations that nearly preclude their use for commercial crop production.

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

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation. The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Woodland management and productivity

MITCHELL G. HASSLER, forester, Soil Conservation Service, helped prepare this section.

Table 5 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 5 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

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

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

The *potential productivity* of merchantable or *important trees* on a soil is expressed as a *site index.* This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species 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 depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 6 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 6, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

MAX L. EVANS, State conservation engineer, Soil Conservation Service, helped prepare this section.

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

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

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

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

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

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

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities. Table 10 shows the kind of limitations for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

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

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

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

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

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

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

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

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

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

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

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

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

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

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

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

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

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

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

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

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

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

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

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

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

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

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

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

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

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

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 10 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

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

Wildlife habitat

JAMES D. MCCALL, wildlife biologist, Soil Conservtion Service, helped prepare this section.

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

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

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, barley, sorghum, millet, buckwheat, soybeans, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are lespedeza, timothy, switchgrass, bromegrass, bluegrass, orchardgrass, clover, alfalfa, trefoil, and vetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bristlegrass, lambsquarter, lespedeza, ragweed, goldenrod, pokeweed, knotweed, beggarweed, panicgrass, bluegrass, and partridgepea.

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

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, hemlock, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are arrowhead, cattail, buttonbush, redosier dogwood, willow, swamp rose, smartweed, and wild millet and rushes, sedges, and reeds.

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

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

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, killdeer, cottontail rabbit, woodchuck, and red fox.

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

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

Soil properties

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

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

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

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

Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 13 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

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

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 16. The estimated classification, without group index numbers, is given in table 13.

Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

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

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately wall drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

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

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

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

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 16.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Joint Highway Research Project at Purdue University.

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

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2483-69); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); and moisture-density, method A (T99-57).

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*4*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Alford series

The Alford series consists of deep, well drained, moderately permeable soils on loess-covered uplands. These soils formed in silty loess. Slopes range from 2 to 12 percent.

Alford soils are similar to Princeton soils and are commonly adjacent to Hennepin and Russell soils on the landscape. Princeton soils have a sandy clay loam or sandy loam B2 horizon. Hennepin soils are steeper than Alford soils and have a thin loess cap or no loess cap. Russell soils have a thinner loess cap than Alford soils. Also, the lower part of the B horizon in Hennepin and Russell soils formed in Wisconsin glacial till.

Typical pedon of Alford silt loam, 2 to 6 percent slopes, eroded, in a cultivated field 200 feet west and 800 feet south of the northeast corner of sec. 5, T. 19 N., R. 9 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

B1—6 to 12 inches; yellowish brown (10YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; many roots; slightly acid; clear smooth boundary.

B21t—12 to 20 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; few thin discontinuous yellowish brown (10YR 5/4) clay films and pale brown (10YR 6/3) silt coatings on faces of some peds; medium acid; clear wavy boundary.

B22t—20 to 32 inches; yellowish brown (10YR 5/8) silty clay loam; moderate coarse and medium subangular blocky structure; firm; common roots; common fine pores; common thin continuous dark yellowish brown (10YR 4/4) clay films on faces of most peds; common pale brown (10YR 6/3) silt coatings on faces of some peds; strongly acid; gradual wavy boundary.

B3—32 to 50 inches; yellowish brown (10YR 5/8) silt loam; weak coarse subangular blocky structure; friable; common fine roots; common fine pores; many light gray (10YR 7/2) silt coatings on faces of most peds; strongly acid; gradual wavy boundary.

C—50 to 72 inches; strong brown (7.5YR 5/6) silt loam; massive; friable; few roots; few vertical cracks filled with light brownish gray (10YR 6/2) silt; medium acid.

The solum is 45 to 60 inches thick. The thickness of the loess cap is 60 to 84 inches. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A2 horizon, if it occurs, has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam. The surface layer is generally strongly acid or medium acid unless limed. The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam. It ranges from very strongly acid to medium acid. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 6. It is strongly acid to medium acid.

Armiesburg series

The Armiesburg series consists of deep, well drained and moderately well drained, moderately permeable soils on bottom land. These soils formed in loamy alluvial deposits. Slopes range from 0 to 2 percent.

Armiesburg soils are similar to Genesee soils and are commonly adjacent to Eel and Genesee soils on the landscape. Genesee soils are well drained. Eel and Genesee soils do not have a mollic epipedon and contain more sand in the solum than Armiesburg soils.

Typical pedon of Armiesburg silty clay in a cultivated field 600 feet north and 1,200 feet east of the southwest corner of sec. 33, T. 17 N., R. 9 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, gray (10YR 5/1) dry; moderate medium granular structure; firm; many roots; neutral; abrupt smooth boundary.

A12—8 to 15 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; firm; many fine roots; neutral; clear smooth boundary.

B21—15 to 27 inches; dark brown (10YR 4/3) silty clay loam; weak medium and coarse subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (10YR 3/3) clay films on faces of some peds; neutral; clear smooth boundary.

B22—27 to 39 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; common fine roots; common fine pores; thin continuous dark brown (10YR 3/3) clay films on faces of some peds; neutral; clear smooth boundary.

C—39 to 62 inches; dark brown (10YR 4/3) silt loam; massive; friable; few roots; neutral.

The solum is 24 to 50 inches thick. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes silt loam. The A horizon is slightly acid or neutral. The B horizon has hue of 10YR, value of 4, and chroma of 3 or 4. In some pedons the lower part of the B2 horizon has a few mottles that have hue of 10YR, value of 4 or 5, and chroma of 2. This horizon is slightly acid or neutral. The C horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is silt loam or silty clay loam.

Dana series

The Dana series consists of deep, moderately well drained, moderately slowly permeable soils on uplands. These soils formed in loess and in the underlying loamy glacial till. Slopes range from 1 to 4 percent.

Dana soils are similar to Xenia soils and are commonly adjacent to Flanagan and Raub soils on the landscape. Dana soils differ from Xenia soils in having a mollic epipedon and from Flanagan and Raub soils in not having mottles in the upper part of the B horizon. Flanagan soils formed in a thicker deposit of loess than Dana or Raub soils. The lower part of the B horizon in Flanagan, Raub, and Xenia soils formed in Wisconsin glacial till.

Typical pedon of Dana silt loam, 1 to 4 percent slopes, in a cultivated field 660 feet east and 100 feet south of the northwest corner of sec. 10, T. 15 N., R. 10 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A12—9 to 12 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

B21t—12 to 20 inches; dark yellowish brown (10YR 4/4) silty clay loam; strong coarse angular blocky structure; firm; common roots; common fine pores; few thin continuous very dark grayish brown (10YR 3/2) clay films on faces of most peds; medium acid; gradual smooth boundary.

B22t—20 to 36 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (10YR 3/3) clay films on faces of most peds; medium acid; clear smooth boundary.

IIB23t—36 to 48 inches; dark brown (10YR 4/3) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; common roots; common fine pores; few thin discontinuous dark brown (10YR 3/3) clay films on faces of most peds; slightly acid; clear smooth boundary.

IIB3—48 to 60 inches; dark brown (10YR 4/3) loam; many medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; few fine roots; few fine pores; mildly alkaline; clear wavy boundary.

IIC—60 to 72 inches; yellowish brown (10YR 5/6) loam; many medium distinct gray (10YR 6/1) mottles; massive; friable; strong effervescence (25 percent calcium carbonate); moderately alkaline.

The solum is 48 to 66 inches thick. The thickness of the loess cap is 22 to 40 inches. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is generally medium acid to neutral. The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles in the lower part of the B horizon have value of 5 to 7 and chroma of 2. Texture in the upper part is silt loam or silty clay loam and in the lower part is clay loam or loam. Reaction ranges from medium acid to neutral. The C horizon has value of 4 or 5 and chroma of 3 to 6. It is loam or silt loam.

Eel series

The Eel series consists of deep, moderately well drained, moderately permeable soils on bottom land. These soils formed in loamy alluvial deposits. Slopes range from 0 to 2 percent.

Eel soils are commonly adjacent to Genesee and Shoals soils on the landscape. Genesee soils have no mottles in the upper 40 inches of the solum. They occupy higher positions on the landscape than Eel soils. Shoals soils are wetter than Eel soils and are in more depressional areas. Shoals soils dominantly have chroma of 2 or less.

Typical pedon of Eel silt loam in a pasture 600 feet south and 400 feet east of the northwest corner of sec. 13, T. 15 N., R. 10 W.

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

C1—4 to 15 inches; dark brown (10YR 4/3) loam; weak fine granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

C2—15 to 21 inches; dark brown (10YR 4/3) loam; few medium faint dark grayish brown (10YR 4/2) mottles; weak fine granular structure; friable; common fine roots; slightly acid; clear smooth boundary.

C3—21 to 36 inches; dark brown (10YR 4/3) sandy loam; common medium distinct grayish brown (10YR 5/2) mottles; weak fine granular structure; very friable; common fine roots; neutral; clear smooth boundary.

C4—36 to 60 inches; dark brown (10YR 4/3) loam; common medium distinct grayish brown (10YR 5/2) mottles; weak fine granular structure; friable; few fine roots; neutral.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. It is dominantly silt loam or loam, but the range includes silty clay loam, clay loam, and sandy loam. Reaction is slightly acid or neutral. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is dominantly loam or silt loam, but it has layers ranging from sandy loam to silty clay loam. Reaction ranges from slightly acid to moderately alkaline.

Elston series

The Elston series consists of deep, well drained, moderately rapidly permeable soils on terraces. These soils formed in loamy glacial outwash and are underlain by sand or sand and gravel. Slopes range from 0 to 6 percent.

Elston soils are similar to Wea soils and are commonly adjacent to Martinsville and Shipshe soils on the landscape. Wea soils contain more silt in the A horizon and less sand in the B horizon than Elston soils. Martinsville soils lack a mollic epipedon and contain less sand and gravel in the B horizon than Elston soils. The solum in Shipshe soils is thinner and contains more gravel than that of Elston soils.

Typical pedon of Elston sandy loam, 0 to 2 percent slopes, in a cultivated field 600 feet south and 100 feet east of the northwest corner of sec. 3, T. 19 N., R. 9 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) sandy loam, very dark brown (10YR 2/2) crushed, dark gray (10YR 4/1) dry; moderate medium granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

A12—10 to 15 inches; very dark brown (10YR 2/2) sandy loam, very dark grayish brown (10YR 3/2) crushed, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; very friable; many fine roots; slightly acid; clear smooth boundary.

B21t—15 to 20 inches; dark brown (10YR 3/3) sandy clay loam, dark brown (10YR 4/3) dry; weak coarse subangular blocky structure; friable; common medium roots; many medium pores; thin discontinuous dark brown (10YR 3/3) clay films on some sand grains and as bridging of sand grains; slightly acid; gradual wavy boundary.

B22t—20 to 26 inches; dark brown (10YR 4/3) sandy clay loam; weak coarse subangular blocky structure; friable; common medium roots; many medium pores; thin discontinuous dark brown (10YR 3/3) clay films on some sand grains and as bridging of sand grains; medium acid; gradual wavy boundary.

B23—26 to 36 inches; dark brown (7.5YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; common medium roots; common medium pores; medium acid; gradual wavy boundary.

B3—36 to 72 inches; dark brown (7.5YR 4/4) loamy sand; weak very coarse subangular blocky structure; very friable; common medium roots; common medium pores; 2 percent fine gravel; medium acid; clear wavy boundary.

C—72 to 80 inches; pale brown (10YR 6/3) sand; single grained; loose; few fine roots; 3 percent fine gravel; strong effervescence (20 percent calcium carbonate); moderately alkaline.

The solum is 48 to 72 inches thick. The sand fraction throughout the solum is medium to very coarse. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is strongly acid to neutral. Some pedons have a thin A3 horizon. The B2t horizon has hue of 7.5YR and 10YR, value of 3 or 4, and chroma of 3 or 4. It is loam, sandy loam, or sandy clay loam. It is strongly acid to slightly acid. The B3 horizon typically has the same color range as the B2t horizon. It is loamy sand or sand and is strongly acid to slightly acid. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is sand or gravelly sand. Reaction ranges from slightly acid to moderately alkaline.

Fincastle series

The Fincastle series consists of deep, somewhat poorly drained, moderately slowly permeable soils on uplands. These soils formed in loess and the underlying loamy glacial till. Slopes range from 0 to 2 percent.

Fincastle soils are similar to Reesville soils and are commonly adjacent to Ragsdale and Xenia soils on the landscape. Reesville soils contain less sand in the lower part of the solum than Fincastle soils. Ragsdale soils have a mollic epipedon and have mottles throughout the solum. Xenia soils are moderately well drained and have mottles in the middle part of the B horizon.

Typical pedon of Fincastle silt loam, 0 to 2 percent slopes, in a cultivated field 150 feet east and 2,400 feet south of the northwest corner of sec. 22, T. 15 N., R. 10 W.

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

A2—8 to 12 inches; brown (10YR 5/3) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium platy structure; friable; many fine roots; slightly acid; clear smooth boundary.

B21t—12 to 20 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; thin discontinuous grayish brown (10YR 5/2) clay films on faces of some peds; strongly acid; clear smooth boundary.

B22t—20 to 38 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct dark grayish brown (10YR 4/2) and light gray (10YR 7/2) mottles; moderate coarse subangular blocky structure; firm; common fine roots; common fine pores; medium discontinuous grayish brown (10YR 5/2) clay films on faces of some peds; slightly acid; gradual smooth boundary.

IIB23t—38 to 50 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of some peds; few medium very dark grayish brown (10YR 3/2) iron and manganese oxide concretions; slightly acid; abrupt wavy boundary.

IIC—50 to 72 inches; yellowish brown (10YR 5/4) and pinkish gray (7.5YR 6/2) loam; massive; friable; 5 percent fine gravel; strong effervescence (35 percent calcium carbonate); moderately alkaline.

The solum is 42 to 66 inches thick. The thickness of the loess cap is 24 to 40 inches. The Ap horizon has hue of 10YR, value of 4 to 6, and chroma of 2. An A1 horizon occurs in undisturbed areas. It is 2 to 3 inches thick and as hue of 10YR, value of 3 or 4, and chroma of 2. Texture is silt loam. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or less. The surface layer is generally strongly acid to slightly acid unless the soil is limed. The B2 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 4. It is strongly acid or medium acid. The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4. It generally has gray mottles and streaks. It is generally loam, but in some pedons it is coarse silty clay loam. Reaction ranges from neutral to moderately alkaline.

Flanagan series

The Flanagan series consists of deep, somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loess and the underlying loamy glacial till. Slopes range from 0 to 2 percent.

Flanagan soils are similar to Ipava soils and are commonly adjacent to Raub and Sable soils. Ipava soils formed in more than 60 inches of loess. Raub soils have a thinner loess cap than Flanagan soils. Sable soils have a silty clay loam surface layer and are underlain with glacial loam till or stratified outwash and glacial drift.

Typical pedon of Flanagan silt loam, 0 to 2 percent slopes, in a cultivated field 100 feet north and 500 feet west of the southeast corner of sec. 16, T. 16 N., R. 9 W.

Ap—0 to 12 inches; very dark brown (10YR 2/2) silt loam, broken and crushed, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A3—12 to 16 inches; very dark gray (10YR 3/1) silt loam, broken and crushed, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; many fine roots; slightly acid; clear smooth boundary.

B21t—16 to 26 inches; very dark grayish brown (10YR 3/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; many fine roots; many very fine pores; many thin weak continuous dark grayish brown (10YR 3/2) clay films on faces of most peds; slightly acid; gradual wavy boundary.

B22t—26 to 35 inches; very dark grayish brown (10YR 3/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; strong coarse subangular blocky structure; firm; many fine roots; many very fine pores; many thin continuous very dark grayish brown (10YR 3/2) clay films on faces of most peds; slightly acid; gradual wavy boundary.

B23t—35 to 49 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; firm; common fine roots; few fine pores; many thin continuous very dark grayish brown (10YR 3/2) clay films on faces of most peds; common continuous very dark grayish brown (10YR 3/2) organic coatings on some peds; neutral; gradual wavy boundary.

B31—49 to 58 inches; mottled yellowish brown (10YR 5/6) and gray (10YR 6/1) silt loam; weak coarse subangular blocky structure; friable; few fine roots; few fine pores; mildly alkaline; gradual wavy boundary.

IIB32—58 to 66 inches; mottled yellowish brown (10YR 5/6) and gray (10YR 6/1) silt loam; weak coarse subangular blocky structure; friable; few fine roots; few fine pores; 5 to 10 percent fine gravel; mildly alkaline; gradual wavy boundary.

IIC—66 to 84 inches; mottled yellowish brown (10YR 5/6) and gray (10YR 6/1) loam; massive; friable; 5 percent fine gravel; slight effervescence (20 percent calcium carbonate); moderately alkaline.

The solum is 48 to 66 inches thick. The thickness of the solum coincides with the depth to effervescent material. The loess is commonly 50 to 60 inches thick, but the solum did not form entirely in loess. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A horizon is commonly silt loam, but in some pedons it is silty clay loam in the lower part. Reaction is slightly acid or neutral. The B2 horizon has hue of 10YR, value of 3 to 6, and chroma of 2 to 4. Mottles have hue of 10YR, value of 5 to 7, and chroma of 1 to 8. The IIB horizon is silt loam, loam, or clay loam. Reaction ranges from medium acid to mildly alkaline. The C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 8. It is commonly loam, but in some pedons it is silt loam, clay loam, or silty clay loam. Reaction is neutral to moderately alkaline.

Fox series

The Fox series consists of well drained, moderately permeable soils that are moderately deep over sand and gravel. These soils formed in loamy glacial outwash on terraces. Slopes range from 0 to 12 percent.

Fox soils are similar to Shipshe soils and are adjacent to Ockley and Rodman soils. Shipshe soils have a mollic epipedon and contain more gravel in the B horizon than Fox soils. Ockley soils have a solum that is more than 40 inches deep. Rodman soils are shallower than Fox soils and are steep or very steep.

Typical pedon of Fox loam, 0 to 2 percent slopes (fig. 12), in a cultivated field 1,140 feet north and 540 feet west of the center of sec. 27, T. 19 N., R. 9 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) loam; moderate medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A2—8 to 11 inches; dark brown (10YR 4/3) loam; moderate medium granular structure; friable; many fine roots; neutral; abrupt wavy boundary.

B21t—11 to 15 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium and coarse subangular blocky structure; firm; many fine roots; many fine pores; thin discontinuous dark brown (7.5YR 4/2) clay films on gravel and as bridging of gravel; 20 percent gravel; medium acid; gradual wavy boundary.

B22t—15 to 20 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium and coarse subangular blocky structure; firm; common fine roots; many fine pores; thin discontinuous dark brown (7.5YR 4/2) clay films on gravel and as bridging of gravel; 20 percent fine gravel; medium acid; gradual wavy boundary.

B23t—20 to 25 inches; dark brown (7.5YR 4/4) gravelly clay loam; weak medium and coarse subangular blocky structure; firm; few fine roots; common fine pores; thin discontinuous dark brown (7.5YR 4/2) clay films on gravel and as bridging of gravel; 30 percent gravel; medium acid; gradual wavy boundary.

B3t—25 to 34 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; common fine pores; thin discontinuous dark brown (7.5YR 4/2) clay films on faces of some peds; 20 percent gravel; very dark grayish brown (10YR 3/2) stains on faces of peds; neutral; abrupt irregular boundary.

IIC—34 to 60 inches; yellowish brown (10YR 5/4) coarse sand and very gravelly coarse sand; weakly stratified; single grained; loose; few fine roots; 30 percent gravel; strong effervescence (35 percent calcium carbonate); moderately alkaline.

The solum is 24 to 40 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam, sandy loam, or clay loam. It is slightly acid or neutral. The A2 horizon, where present, has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. It is loam, sandy loam, or clay loam. It is slightly acid or neutral. The Bt horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 or 4; and chroma of 3 or 4. It is loam, gravelly clay loam, or sandy clay loam. In some pedons, tongues of the B3t horizon extend several inches into the IIC horizon. Reaction is neutral or mildly alkaline near the contact with the IIC horizon. The IIC horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Genesee series

The Genesee series consists of deep, well drained, moderately permeable soils on bottom land. These soils formed in loamy alluvial deposits. Slopes range from 0 to 2 percent.

Genesee soils are commonly adjacent to Armiesburg, Eel, and Stonelick soils on the landscape. Armiesburg soils have a mollic epipedon and contain less sand in the solum than Genesee soils. Eel soils are mottled below a depth of 20 inches. They are on flats or in slightly depressional areas. Stonelick soils are more sandy than Genesee soils and are in slightly higher positions nearer the stream.

Typical pedon of Genesee silt loam in a cultivated field 2,000 feet north and 1,200 feet east of the southwest corner of sec. 26, T. 17 N., R. 9 W.

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

C1—10 to 18 inches; dark yellowish brown (10YR 3/4) loam; moderate fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

C2—18 to 32 inches; dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; many fine roots; neutral; clear smooth boundary.

C3—32 to 56 inches; dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; common fine roots; mildly alkaline; gradual wavy boundary.

C4—56 to 72 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; common fine roots; slight effervescence (7 percent calcium carbonate); moderately alkaline.

The soil ranges from slightly acid to moderately alkaline throughout. Free carbonates typically are above a depth of 25 to 38 inches. The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is dominantly silt loam or loam, but the range includes silty clay loam and sandy loam. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is dominantly silt loam or loam, but it has layers ranging from sandy loam to silty clay loam.

Gosport series

The Gosport series consists of moderately deep, moderately well drained, very slowly permeable soils on terraces and uplands. These soils formed in residuum over shale and sandstone. Slopes range from 50 to 70 percent.

Gosport soils are commonly adjacent to Hennepin, High Gap, and Shadeland soils. Hennepin soils contain less clay in the solum than Gosport soils, are more nearly neutral throughout, and are in a slightly higher position on the landscape. They formed in a thin layer of loess over Wisconsin glacial till. High Gap and Shadeland soils have an argillic horizon. High Gap soils are nearly level to gently sloping. They have a thin cover of glacial drift over sandstone bedrock. Shadeland soils are nearly level. They formed in a thin layer of loess and glacial drift over sandstone bedrock. Also, they are mottled in the subsoil.

Typical pedon of Gosport shaly silt loam, 50 to 70 percent slopes, in a wooded area 500 feet north and 700 feet east of the southwest corner of sec. 23, T. 16 N., R. 9 W.

O2—1 inch to 0; black (10YR 2/1) undecomposed and decomposed leaf litter.

A1—0 to 3 inches; very dark brown (10YR 2/2) shaly silt loam; moderate medium granular structure; friable; many fine roots; slightly acid; gradual wavy boundary.

A2—3 to 9 inches; grayish brown (2.5Y 5/2) shaly silty clay loam; weak coarse subangular blocky structure; firm; many fine roots; 15 percent weathered sandstone fragments; medium acid; clear wavy boundary.

B2—9 to 16 inches; olive brown (2.5Y 4/4) shaly silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; 15 percent weathered sandstone fragments; strongly acid; clear wavy boundary.

B3—16 to 25 inches; olive (5Y 5/3) shaly silty clay loam; weak coarse subangular blocky structure; firm; few fine roots; strongly acid; clear wavy boundary.

Cr—25 to 40 inches; light olive gray (5Y 6/2) clay shale; massive; very firm; medium acid.

The thickness of the solum ranges from 10 to 28 inches. The A1 horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. Texture ranges from shaly silt loam to clay loam. The A2 horizon has hue of 2.5Y, value of 3 to 5, and chroma of 2 or 3. The surface layer is very strongly acid or strongly acid. The B2 horizon has hue of 2.5Y to 7.5YR, value of 4 to 6, and chroma of 3 or 4. The B3 horizon has hue of 2.5Y to 5Y, value of 5, and chroma of 2 or 3. It ranges from shaly silty clay loam to clay and from extremely acid to medium acid. The Cr horizon has hue of 5Y to 7.5YR, value of 6 to 8, and chroma of 2 to 6.

Hennepin series

The Hennepin series consists of deep, well drained, moderately slowly permeable soils on uplands. These soils formed in loamy glacial till. Slopes range from 25 to 50 percent.

Hennepin soils are adjacent to Miami, Russell, and Xenia soils on the landscape. Miami, Russell, and Xenia soils are less sloping than Hennepin soils, have a thicker loess cap, and have a deeper solum. Also, they have an argillic horizon.

Typical pedon of Hennepin loam, 25 to 50 percent slopes, in a wooded area 1,800 feet south and 100 feet west of the northeast corner of sec. 33, T. 16 N., R. 9 W.

A1—0 to 5 inches; dark gray (10YR 4/1) loam; moderate medium granular structure; friable; many roots; neutral; clear smooth boundary.

B—5 to 13 inches; dark brown (10YR 4/3) loam; moderate medium granular structure; friable; many fine roots; few fine pores; 3 percent fine gravel; many fine dark gray (10YR 4/1) organic coatings in root channels; neutral; clear wavy boundary.

C1—13 to 20 inches; brown (10YR 5/3) loam; few fine faint pale brown (10YR 6/3) and few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; common fine roots; 3 percent fine gravel; mildly alkaline; clear smooth boundary.

C2—20 to 60 inches; gray (10YR 6/1) loam; many medium distinct pale brown (10YR 6/3) mottles; massive; friable; few roots; 3 percent fine gravel; slight effervescence (7 percent calcium carbonate); moderately alkaline.

The solum is 12 to 20 inches thick. It is very weakly expressed. The content of coarse fragments ranges from 1 to 4 percent. The A horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is commonly loam, but the range includes silt loam, sandy loam, and clay loam. Reaction is slightly acid or neutral. The B horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. The range in texture is similar to that of the A horizon. Reaction is slightly acid to moderately alkaline. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 3. It is loam or clay loam. It is mildly alkaline or moderately alkaline.

High Gap series

The High Gap series consists of moderately deep, well drained, moderately permeable soils on terraces. These soils formed in loess and glacial drift over sandstone bedrock. Slopes range from 2 to 6 percent.

High Gap soils are similar to Fox soils and are commonly adjacent to Gosport and Shadeland soils on the landscape. Fox soils contain more gravel in the subsoil than High Gap soils and are underlain with sand and gravel. Gosport soils contain more clay in the solum than High Gap soils and are steeper. They are underlain with shale and sandstone. Shadeland soils are mottled in the B horizon.

Typical pedon of High Gap silt loam, 2 to 6 percent slopes, in a pasture 900 feet north and 900 feet west of the southeast corner of sec. 15, T. 19 N., R. 9 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many fine roots; strongly acid; abrupt smooth boundary.

IIB2t—8 to 34 inches; yellowish brown (10YR 5/6) and pale brown (10YR 6/3) clay loam; moderate medium subangular blocky structure; firm; common fine roots; few fine pores; 5 percent sandstone fragments; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of some peds; few fine black (10YR 2/1) iron and manganese oxide concretions; strongly acid; clear smooth boundary.

IIB3t—34 to 38 inches; yellowish brown (10YR 5/4 and 5/8) channery clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of some peds; 25 percent sandstone fragments; strongly acid; abrupt smooth boundary.

IIIR—38 inches; hard sandstone.

The thickness of the solum ranges from 24 to 40 inches. The thickness of loess cap is less than 10 inches. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is strongly acid or very strongly acid. The B2 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam or clay loam. The B3 horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 8. It is channery clay loam or clay loam. The B horizon ranges from medium acid to very strongly acid. The R horizon is commonly sandstone or interbedded sandstone and shale.

Ipava series

The Ipava series consists of deep, somewhat poorly drained, moderately slowly permeable soils on uplands. These soils formed in loess. Slopes range from 0 to 2 percent.

Ipava soils are similar to Flanagan and Raub soils and are adjacent to Sable soils on the landscape. Flanagan soils formed in 40 to 60 inches of loess and in the underlying loamy glacial till. Raub soils formed in 22 to 42 inches of loess and in the underlying loamy glacial till. Sable soils do not have an argillic horizon. They are in wetter, more depressional areas than Ipava soils and contain more clay in the surface layer. They are underlain with glacial till, outwash, or drift.

Typical profile of Ipava silt loam, 0 to 2 percent slopes, in a cultivated field 400 feet west and 2,375 feet south of the northeast corner of sec. 17, T. 19 N., R. 9 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—8 to 12 inches; very dark gray (10YR 3/1) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

A3—12 to 18 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B21t—18 to 26 inches; dark grayish brown (10YR 4/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thick continuous brown (10YR 4/3) clay films on faces of most peds; very dark grayish brown (10YR 3/2) organic coatings on faces of some peds; medium acid; clear smooth boundary.

B22t—26 to 32 inches; light brownish gray (10YR 6/2) silty clay loam; many distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thick continuous brown (10YR 4/3) clay films on faces of most peds; very dark grayish brown (10YR 3/2) organic coatings on faces of some peds; medium acid; gradual smooth boundary.

B23t—32 to 43 inches; grayish brown (10YR 5/2) silty clay loam; many coarse distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; common fine roots; common fine pores; thick dark yellowish brown (10YR 4/4) clay films on faces of most peds; very dark brown (10YR 2/2) organic coatings on faces of some peds; slightly acid; diffuse smooth boundary.

B3—43 to 51 inches; light gray (10YR 7/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; few fine pores; black (10YR 2/1) organic coatings on faces of most peds; neutral; clear smooth boundary.

C—51 to 72 inches; light gray (10YR 7/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; strong effervescence (20 percent calcium carbonate); moderately alkaline.

The solum is 40 to 60 inches thick. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A horizon is dominantly silt loam but ranges to silty clay loam in the lower part. Reaction is slightly acid or neutral. A B1t horizon is in some pedons. The B2t horizon has hue of 2.5Y to 10YR, value of 4 to 6, and chroma of 2 to 4. It has many mottles, which have hue of 10YR, value of 5 or 6, and chroma of 2 to 6. The C horizon has hue of 2.5Y or 10YR, value of 5 to 7, and chroma of 2 or 3. Mottles have hue of 10YR, value of 6 to 7, and chroma of 4 to 6. Reaction is mildly alkaline or moderately alkaline.

Martinsville series

The Martinsville series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in loamy glacial outwash and are underlain by stratified silt and sand. Slopes range from 0 to 6 percent.

Martinsville soils are similar to Rush soils and are commonly adjacent to Ockley and Whitaker soils on the landscape. Rush soils contain more silt in the solum than Martinsville soils and contain gravel in the lower part of the B horizon. Ockley soils are more gravelly in the lower part of the solum than Martinsville soils. Whitaker soils are somewhat poorly drained and have mottles throughout the B horizon. They are on flats or in slight depressions in the landscape.

Typical pedon of Martinsville loam, 0 to 2 percent slopes, in a cultivated field 50 feet north and 1,200 feet east of the southwest corner of sec. 7, T. 19 N., R. 9 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) loam; moderate fine granular structure; friable; many roots; neutral; abrupt smooth boundary.

A2—8 to 13 inches; dark yellowish brown (10YR 4/4) loam; weak medium platy structure; friable; many roots; neutral; clear smooth boundary.

B1t—13 to 17 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; many fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; slightly acid; clear smooth boundary.

B21t—17 to 30 inches; dark brown (7.5YR 4/4) clay loam; strong medium subangular blocky structure; firm; common fine roots; many fine pores; thin continuous dark brown (7.5YR 4/4) clay films on faces of most peds; very dark grayish brown (10YR 3/2) organic coatings on faces of some peds; strongly acid; clear smooth boundary.

B22t—30 to 46 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (10YR 4/3) clay films on faces of most peds; very dark grayish brown (10YR 3/2) organic coatings on faces of some peds; strongly acid; gradual smooth boundary.

B23t—46 to 60 inches; yellowish brown (10YR 5/6) clay loam; weak coarse subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of some peds; slightly acid; gradual smooth boundary.

IIC—60 to 72 inches; yellowish brown (10YR 5/4) stratified fine sand and sandy clay loam; single grained; loose; few roots; slight effervescence (8 percent calcium carbonate); moderately alkaline.

The solum is 44 to 66 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is loam or silt loam and, less commonly, fine sandy loam or sandy loam. Reaction ranges from medium acid to neutral. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam or silt loam. Reaction ranges from medium acid to neutral. The B2 horizon has hue of 7.5YR and 10YR, value of 4 to 6, and chroma of 3 to 6. It is dominantly clay loam but ranges from sandy loam to silty clay loam. Reaction ranges from strongly acid to neutral. The IIC horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is stratified silt loam, loam, sandy loam, and sand.

Miami series

The Miami series consists of deep, well drained soils on uplands. These soils are moderately permeable in the solum and moderately slowly permeable in underlying till. They formed in loess and the underlying loamy glacial till. Slopes range from 6 to 18 percent.

Miami soils are similar to Alford and Russell soils and are commonly adjacent to Xenia soils on the landscape. The solum in Alford and Russell soils is deeper than that in Miami soils and contains more silt. Alford soils formed in loess that is more than 5 feet thick. Russell soils formed in 20 to 40 inches of loess and in the underlying till. Xenia soils have mottles in the middle part of the B2 horizon. They have a thicker loess cap and a thicker solum than Miami soils.

Typical pedon of Miami silt loam, 12 to 18 percent slopes, eroded, in a pasture 2,100 feet east and 2,000 feet north of the southwest corner of sec. 5, T. 14 N., R. 9 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam; moderate fine and medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

IIB21t—6 to 15 inches; yellowish brown (10YR 5/6) and brown (10YR 5/3) clay loam; moderate medium subangular blocky structure; firm; common roots; many fine pores; few thin continuous dark brown (7.5YR 4/4) clay films on faces of most peds; 5 percent fine gravel; medium acid; clear smooth boundary.

IIB22t—15 to 28 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) sandy clay loam; moderate medium and coarse subangular blocky structure; firm; common roots; common fine pores; few thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; 5 percent fine gravel; neutral; clear wavy boundary.

IIC—28 to 60 inches; pale brown (10YR 6/3) loam; massive; friable; 10 percent fine gravel; slight effervescence (20 percent calcium carbonate); moderately alkaline.

The thickness of the solum ranges from 24 to 36 inches. It generally coincides with the depth to carbonates. The Ap horizon has hue of 10YR, value of 4 of 5, and chroma of 2 to 4. The A2 horizon, where present, has hue of 10YR, value of 5, and chroma of 3 or 4. The A horizon is dominantly silt loam but is clay loam in some severely eroded areas. Reaction ranges from medium acid to neutral. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, sandy clay loam, or loam. Reaction ranges from strongly acid to neutral. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 8. It is loam or sandy loam. It is mildly or moderately alkaline.

Ockley series

The Ockley series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in loess and loamy glacial outwash and in the underlying stratified sand and very gravelly sand. Slopes range from 0 to 6 percent.

Ockley soils are similar to Fox soils and are commonly adjacent to Martinsville and Shipshe soils. Fox and Shipshe soils have a thinner solum than Ockley soils. Martinsville soils contain no gravel in the solum, and Shipshe soils have a mollic epipedon and have a high content of gravel in the solum.

Typical pedon of Ockley silt loam, 0 to 2 percent slopes, in a cultivated field 500 feet north and 400 east of the southwest corner of sec. 22, T. 19 N., R. 9 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A2—7 to 11 inches; dark brown (10YR 3/3) silt loam; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B1t—11 to 17 inches; brown (10YR 5/3) silt loam; weak medium subangular blocky structure; firm; many fine roots; few fine pores; thin discontinuous dark brown (10YR 4/3) clay films on faces of some peds; neutral; clear smooth boundary.

IIB21t—17 to 32 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (7.5YR 4/4) clay films on faces of most peds; slightly acid; gradual wavy boundary.

IIB22t—32 to 46 inches; dark brown (7.5YR 4/4) sandy clay loam; weak coarse subangular blocky structure; firm; common fine roots; common fine pores; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of some peds; 5 percent fine gravel; medium acid; clear wavy boundary.

IIB23t—46 to 58 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium angular blocky structure; firm; few fine roots; few fine pores; thin dark brown (7.5YR 3/2) clay films on faces of some peds; 25 percent coarse gravel; medium acid; gradual wavy boundary.

IIC—58 to 72 inches; yellowish brown (10YR 5/4) coarse sand and very gravelly coarse sand; single grained; loose; few fine roots; 60 percent coarse gravel; slight effervescence (16 percent calcium carbonate); moderately alkaline.

The solum is 48 to 60 inches thick. The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. The A2 horizon has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. Texture is loam or silt loam. Reaction is slightly acid or neutral. The B2 horizon has hue of 7.5YR or 10YR, value 4 or 5, and chroma of 3 to 6. Reaction ranges from very strongly acid to slightly acid. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is coarse sand and gravelly coarse sand. It is mildly alkaline or moderately alkaline.

Palms series

The Palms series consists of very poorly drained soils on bottom land. These soils formed in organic material over mineral material. Permeability is moderately rapid in the upper part and moderate in the lower part. Slopes range from 0 to 2 percent.

Palms soils are adjacent to Eel, Shoals, and Sloan soils on the landscape. Eel, Sloan, and Shoals soils formed in mineral material. Eel soils are generally in the flatter, higher lying positions on the landscape, and Sloan and Shoals soils are in slightly depressional areas.

Typical pedon of Palms muck in an idle field 1,400 feet west and 1,300 feet south of the northeast corner of sec. 28, T. 17 N., R. 9 W.

Oa1—0 to 17 inches; black (10YR 2/1) sapric material, black (N 2/0) rubbed and pressed; about 5 percent fiber, 2 percent rubbed; weak medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

Oa2—17 to 31 inches; black (N 2/0) sapric material, rubbed and pressed; about 5 percent fiber, 2 percent rubbed; weak medium subangular blocky structure; friable; few fine roots; neutral; clear smooth boundary.

Oa3—31 to 40 inches; black (N 2/0) sapric material, rubbed and pressed; about 20 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

IICg—40 to 72 inches; gray (5Y 5/1) clay loam; common medium distinct light olive brown (2.5Y 5/6) mottles; massive; firm; many small snail shells; few pebbles; slight effervescence (8 percent calcium carbonate); moderately alkaline.

The organic layer is commonly 20 to 45 inches thick, but it ranges from 16 to 50 inches in thickness. The Oa horizon is black (N 2/0, 7.5YR 2/1, or 10YR 2/1). It is mainly sapric material, but some pedons contain a small amount of hemic material. The organic part of the subsurface horizons have hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. Some horizons have hue of N and value of 2 or 3. The organic material in these layers is dominantly sapric material. Some pedons have thin layers of fibric material. The IICg horizon has hue of 2.5Y, 5Y, or 10YR; value of 3 or 4; and chroma of 1 or 2. It is silt loam, loam, clay loam, fine sandy loam, or silt. Reaction ranges from slightly acid to moderately alkaline.

Plano series

The Plano series consists of deep, well drained and moderately well drained, moderately permeable soils on uplands. These soils formed in loess or silty material and loamy glacial outwash and are underlain with stratified sand. Slopes ranges from 0 to 2 percent.

Plano soils are similar to Proctor and Tama soils and are adjacent to Raub soils. Proctor soils formed in thinner deposits of loess and in the underlying glacial outwash. Tama soils formed in thick deposits of loess or silty material. Raub soils have mottles in the B horizon and formed in loess and the underlying loamy glacial till.

Typical pedon of Plano silt loam, 0 to 2 percent slopes, in a cultivated field 300 feet east and 600 feet south of the center of sec. 21, T. 19 N., R. 10 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A12—8 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B1—14 to 21 inches; dark brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; many fine roots; common fine pores; medium acid; clear smooth boundary.

B21t—21 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (10YR 4/3) clay films on faces of most peds; medium acid; clear smooth boundary.

B22t—32 to 42 inches; dark yellowish brown (10YR 4/4) silty clay loam; few medium faint dark brown (10YR 4/3) mottles; moderate medium and coarse subangular blocky structure; firm; common fine roots; common fine pores; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of most peds; medium acid; clear smooth boundary.

B3—42 to 48 inches; yellowish brown (10YR 5/4) silt loam; few medium faint brown (10YR 5/3) mottles; weak coarse subangular blocky structure; friable; few fine roots; few fine pores; slightly acid; clear wavy boundary.

IIC—48 to 72 inches; dark brown (7.5YR 4/4) stratified sandy loam and fine sand; massive; friable; few fine roots; neutral.

The solum is 44 to 66 inches thick. The thickness of loess cap is 40 to 60 inches. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. The A3 horizon has hue of 10YR, value of 3, and chroma of 3 or 4. Reaction ranges from medium acid to neutral. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles have hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Reaction ranges from medium acid to neutral. The IIC horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is generally stratified. It is sandy loam, fine sandy loam, and fine sand. Reaction ranges from medium acid to moderately alkaline.

Princeton series

The Princeton series consists of deep, well drained soils that are moderately permeable in the upper part and moderately rapidly permeable in the lower part. These soils are on uplands. They formed in thick deposits of wind-blown fine sand and silt. Slopes range from 8 to 15 percent.

Princeton soils are similar to Alford soils and are commonly adjacent to Miami and Russell soils on the landscape. Alford soils formed in deep loess. Miami and Russell soils formed in loess and the underlying loamy glacial till.

Typical pedon of Princeton fine sandy loam, 8 to 15 percent slopes, in a pasture 500 feet west and 1,100 feet south of the northeast corner of sec. 29, T. 18 N., R. 10 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) fine sandy loam; weak medium granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

A2—6 to 11 inches; dark yellowish brown (10YR 4/4) fine sandy loam; moderate medium granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

B21t—11 to 19 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; firm; many fine roots; common fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; medium acid; clear smooth boundary.

B22t—19 to 35 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium angular and subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; strongly acid; clear wavy boundary.

B23—35 to 44 inches; strong brown (7.5YR 5/6) sandy loam; weak coarse subangular blocky structure; friable; few fine roots; few fine pores; neutral; clear wavy boundary.

C—44 to 68 inches; yellowish brown (10YR 5/4) fine sand with a few bands of dark brown (7.5YR 4/4) sandy loam; single grained; loose; few fine roots; neutral.

The solum is 40 to 50 inches thick. The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Reaction ranges from medium acid to neutral. The B2 horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 4 to 6. Texture is sandy loam, sandy clay loam, or light clay loam. Reaction ranges from very strongly acid to neutral. The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, chroma of 3 to 6. It is stratified. It is loamy sand, fine sand, fine sandy loam, or coarse silt. Reaction ranges from slightly acid to moderately alkaline.

Proctor series

The Proctor series consists of deep, well drained and moderately well drained, moderately permeable soils on outwash plains. These soils formed in loess or silty material and the underlying loamy glacial outwash and are underlain with stratified sandy outwash. Slopes range from 0 to 6 percent.

Proctor soils are similar to Martinsville soils and are commonly adjacent to Plano and Raub soils. Martinsville soils lack a mollic epipedon and have a thinner loess cap than Proctor soils. Plano soils have a thicker loess cap. Raub soils have mottles in the B horizon and formed in loess and the underlying glacial till.

Typical pedon of Proctor silt loam, 0 to 2 percent slopes, in a cultivated field 2,800 feet south and 200 feet west of the northeast corner of sec. 28, T. 19 N., R. 10 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine roots; neutral; clear smooth boundary.

A12—8 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B1t—13 to 18 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; many fine roots; common fine pores; thin dark brown (10YR 4/3) clay films on faces of some peds; dark discontinuous grayish brown (10YR 4/2) organic coatings on faces of some peds; medium acid; clear smooth boundary.

B21t—18 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark brown (10YR 4/3) clay films on faces of most peds; strongly acid; gradual wavy boundary.

IIB3—34 to 50 inches; dark yellowish brown (10YR 4/4) stratified silt loam and loam; moderate medium subangular blocky structure; friable; common fine roots; few fine pores; medium acid; gradual wavy boundary.

IIC—50 to 72 inches; strong brown (7.5YR 5/6) stratified sandy loam and loam; massive; friable; few fine roots; medium acid.

The solum is 46 to 60 inches thick. The loess cap ranges from 28 to 40 inches in thickness. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. The A12 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A horizon is slightly acid or neutral. The B1 horizon, if it occurs, has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or silty clay loam. It is medium acid or slightly acid. The B2t horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. The IIB3 horizon commonly is the same color as the B2t horizon. It is generally stratified. It is silt loam or loam. Reaction ranges from strongly acid to slightly acid. The IIC horizon is stratified. It has hue of 7.5YR or 10YR, value of 5, and chroma of 2 to 6. Texture is sandy loam, loam, or silt loam. Reaction is medium acid or slightly acid.

Ragsdale series

The Ragsdale series consists of deep, very poorly drained, slowly permeable, nearly level to slightly depressional soils on uplands. These soils formed in loess. Slopes range from 0 to 2 percent.

Ragsdale soils are similar to Sable soils and are adjacent to Reesville and Xenia soils on the landscape. Sable soils have a silty clay loam surface layer and are underlain with glacial loam till or stratified outwash and glacial drift. They do not have an argillic horizon. Reesville and Xenia soils do not have a mollic epipedon and have a thinner loess cap than Ragsdale soils. Also, Xenia soils have mottles in the middle part of the B horizon.

Typical pedon of Ragsdale silt loam in a cultivated field 1,100 feet east and 800 feet north of the southwest corner of sec. 32, T. 15 N., R. 9 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; weak medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—8 to 13 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate medium granular structure; firm; many fine roots; slightly acid; gradual wavy boundary.

B1—13 to 18 inches; very dark grayish brown (2.5Y 3/2) silty clay loam; common medium distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; common fine roots; slightly acid; clear smooth boundary.

B21t—18 to 34 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct very dark grayish brown (10YR 3/2) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin continuous grayish brown (10YR 5/2) clay films on faces of most peds; slightly acid; clear smooth boundary.

B22t—34 to 46 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct very dark grayish brown (10YR 3/2) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin continuous grayish brown (10YR 5/2) clay films on faces of most peds; neutral; gradual smooth boundary.

C1—46 to 57 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) silt loam; massive; friable; neutral; clear smooth boundary.

IIC2—57 to 80 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; slight effervescence (10 percent calcium carbonate); moderately alkaline.

The solum is 40 to 60 inches thick. The loess cap is 45 to 60 inches thick. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Texture is silt loam or silty clay loam. Reaction is slightly acid or neutral. The B horizon has hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 1 to 4. Mottles have hue of 10YR, value of 3 to 6, and chroma of 2 to 6. Texture is silty clay loam or silt loam. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6. It is mottled. Texture ranges from silty clay loam to loam. Reaction ranges from neutral to moderately alkaline.

Raub series

The Raub series consists of deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in loess and the underlying loamy glacial till. Slopes range from 0 to 2 percent.

Raub soils are similar to Ipava soils and are adjacent to Flanagan and Sable soils. Ipava soils are more clayey in the control section than Raub soils. Flanagan soils have a thicker loess cap than Raub soils. Sable soils have a silty clay loam surface layer and are underlain with loam glacial till or stratified outwash and glacial drift.

Typical pedon of Raub silt loam, 0 to 2 percent slopes, in a cultivated field 300 feet east and 100 feet north of the southwest corner of sec. 3, T. 15 N., R. 10 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—7 to 13 inches; very dark brown (10YR 2/2) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B1t—13 to 18 inches; very dark grayish brown (10YR 3/2) silty clay loam; many medium faint brown (10YR 4/3) mottles; weak medium subangular blocky structure; firm; many fine roots; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of some peds; slightly acid; clear smooth boundary.

B21t—18 to 33 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thick continuous very dark grayish brown (10YR 3/2) clay films on faces of most peds; common fine very dark grayish brown (10YR 3/2) organic coatings on faces of peds; medium acid; clear smooth boundary.

B22t—33 to 37 inches; yellowish brown (10YR 5/8) silty clay loam; many medium distinct grayish brown (10YR 5/2) and pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm;

common fine roots; common fine pores; thick continuous very dark grayish brown (10YR 3/2) clay films on faces of most peds; medium acid; clear smooth boundary.

IIB23t—37 to 54 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; thin discontinuous clay films on faces of some peds; slightly acid; clear smooth boundary.

IIB3—54 to 62 inches; light brownish gray (10YR 6/2) loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; few fine pores; neutral; clear smooth boundary.

IIC—62 to 72 inches; yellowish brown (10YR 5/4) loam; few fine distinct grayish brown (10YR 5/2) mottles; massive; friable; strong effervescence (25 percent calcium carbonate); moderately alkaline.

The solum is 42 to 66 inches thick. The loess cap is typically 36 to 40 inches thick but ranges from 22 to 42 inches. In some pedons, thin strata of loam, clay loam, or sandy loam are at the contact point of the loess and the till. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Reaction ranges from medium acid to neutral. The B horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 to 6. It is mottled. Reaction is strongly acid or medium acid in the upper part and neutral or mildly alkaline in the lower part. The C horizon has hue of 10YR, value of 5, and chroma of 1 to 4. It is loam or clay loam. It is mildly alkaline or moderately alkaline.

Reesville series

The Reesville series consists of deep, somewhat poorly drained, moderately permeable or moderately slowly permeable soils on loess-covered uplands. These soils formed in loess over till. Slopes range from 0 to 2 percent.

Reesville soils are similar to Fincastle soils and are adjacent to Ragsdale and Xenia soils. The lower part of the B horizon in Fincastle soils formed in loamy glacial till. Ragsdale soils have a mollic epipedon and are in the wetter, more depressional areas.

Typical pedon of Reesville silt loam, 0 to 2 percent slopes, in a cultivated field 600 feet north and 2,100 feet east of the center of sec. 33, T. 17 N., R. 9 W.

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

A2—9 to 12 inches; light brownish gray (10YR 6/2) silt loam; few medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

B21t—12 to 25 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; few fine pores; thin discontinuous brown (10YR 5/3) clay films on faces on some peds; medium acid; clear smooth boundary.

B22t—25 to 38 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct grayish brown (10YR 5/2) and many medium distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; common fine roots; few fine pores; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of some peds; medium acid; clear smooth boundary.

C1—38 to 54 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct grayish brown (10YR 5/2) and pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; friable; few fine roots; strong effervescence (20 percent calcium carbonate); moderately alkaline; clear smooth boundary.

IIC2—54 to 66 inches; brown (10YR 5/3) loam; common medium distinct grayish brown (10YR 5/2), yellowish brown (10YR 5/6), and light gray (10YR 7/2) mottles; massive; friable; few roots; 5 percent fine gravel; strong effervesence (25 percent calcium carbonate); moderately alkaline.

The solum is 30 to 60 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It is slightly acid to neutral. The A2 horizon has hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 2 to 4. It is mottled. The B horizon has hue of 2.5Y to 10YR, value of 4 to 6, and chroma of 2 to 6. It is mottled. It is silt loam or silty clay loam. The B3 horizon is calcareous in some pedons. Reaction ranges from very strongly acid to mildly alkaline throughout the B horizon. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 6. The IIC horizon has hue of 10YR, value of 5 to 7, and chroma of 2 or 3.

Rodman series

The Rodman series consists of excessively drained, very rapidly permeable soils on terraces above bottom land. These soils are shallow over coarse sand and gravel. They formed in loamy outwash over gravelly sand and sand. Slopes range from 25 to 50 percent.

Rodman soils are adjacent to Fox and Shoals soils. Fox soils lack a mollic epipedon and have a thicker solum than Rodman soils. Shoals soils are on bottom land. They have mottles in the C horizon, lack a mollic epipedon, and formed in loamy alluvium.

Typical pedon of Rodman gravelly loam, 25 to 50 percent slopes, in a forested area 50 feet west and 100 feet south of the northeast corner of sec. 30, T. 18 N., R. 9 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly loam; weak fine granular structure; friable; many fine roots; 5 percent gravel; neutral; clear smooth boundary.

B—6 to 11 inches; dark brown (7.5YR 4/4) gravelly loam; weak fine granular structure; friable; common fine roots; few fine pores; 15 percent gravel; mildly alkaline; clear wavy boundary.

C—11 to 60 inches; yellowish brown (10YR 5/4) coarse sand and very gravelly coarse sand; single grained; loose; 60 percent gravel; strong effervescence (25 percent calcium carbonate); moderately alkaline.

The solum is 8 to 15 inches thick. The A1 horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. It is gravelly loam or sandy loam. The B horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. It is loam or gravelly loam. It is neutral or mildly alkaline. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4.

Rush series

The Rush series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and outwash and are underlain with stratified sand and gravelly sand. Slopes range from 0 to 6 percent.

Rush soils are similar to Russell soils and are adjacent to Alford and Xenia soils. Russell soils contain less sand and gravel in the lower part of the IIB horizon than Rush soils and have a IIC horizon of glacial loam till. Alford soils formed in deep silt. Xenia soils have mottles in the middle part of the B horizon.

Typical pedon of Rush silt loam, 0 to 2 percent slopes, in a cultivated field 1,800 feet east and 800 feet south of the northwest corner of sec. 21, T. 15 N., R. 9 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

A2—8 to 11 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many fine roots; slightly acid; clear wavy boundary.

B21t—11 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common roots; few fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; slightly acid; abrupt wavy boundary.

IIB22t—34 to 40 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; few fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; medium acid; clear wavy boundary.

IIB23t—40 to 60 inches; dark brown (7.5YR 4/4) sandy clay loam; weak medium subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; 5 percent gravel; slightly acid; abrupt wavy boundary.

IIB3t—60 to 65 inches; dark brown (10YR 4/3) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark brown (10YR 3/3) clay films on faces of some peds; 40 percent gravel; neutral; abrupt wavy boundary.

IIIC—65 to 72 inches; dark yellowish brown (10YR 4/4) and light gray (10YR 7/2) sand and very gravelly sand; single grained; loose; 40 percent gravel; strong effervescence (30 percent calcium carbonate); moderately alkaline.

The solum is 45 to 70 inches thick. It formed in silty material and in 12 to 40 inches of loamy outwash and is underlain by stratified sand and very gravelly sand. An A1 horizon is in undisturbed areas. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Ap horizon has hue of 7.5YR and 10YR, value of 4 or 5, and chroma of 2 to 4. Reaction is medium acid to neutral. The A2 horizon is the same color as the Ap horizon. Reaction is strongly acid or medium acid. The B2t horizon has hue of 7.5YR and 10YR, value of 4 or 5, and chroma of 3 to 8. It is silt loam or silty clay loam in the upper part and clay loam in the lower part. In some pedons the lower part ranges to sandy clay loam, gravelly clay loam, and loam. Reaction is strongly acid or medium acid in upper part and neutral in the lower part. The IIIC horizon has hue of 10YR, value of 4 to 7, and chroma of 2 to 4. It is sand or very gravelly sand that varies considerably in content of gravel. It is mildly alkaline or moderately alkaline.

Russell series

The Russell series consists of deep, well drained, moderately permeable and moderately slowly permeable soils on uplands. These soils formed in loess and the underlying till. Slopes range from 2 to 12 percent.

Russell soils are similar to Alford soils and are commonly adjacent to Fincastle and Xenia soils. Alford soils formed in deposits of deeper silt. Fincastle soils are mottled throughout the B horizon, and Xenia soils are mottled in the lower part of the B horizon.

Typical pedon of Russell silt loam, 2 to 6 percent slopes, eroded, in a cultivated field 1,400 feet east and 700 feet south of the northwest corner of sec. 18, T. 17 N., R. 9 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; moderate fine and medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—7 to 15 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; thin dark yellowish brown (10YR 4/4) clay films on faces of some peds; medium acid; clear smooth boundary.

B22t—15 to 30 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium and coarse subangular blocky structure; firm; common fine roots; common fine pores; thin dark brown (7.5YR 4/4) clay films on faces of some peds; medium acid; clear smooth boundary.

IIB23t—30 to 41 inches; yellowish brown (10YR 5/6) clay loam; moderate medium and coarse subangular blocky structure; firm; common fine roots; common fine pores; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of most peds; strongly acid; clear wavy boundary.

IIB3t—41 to 55 inches; dark yellowish brown (10YR 4/4) clay loam; weak coarse subangular blocky structure; firm; few fine roots; few fine pores; thin dark brown (7.5YR 4/4) clay films on faces of some peds; 5 percent fine gravel; medium acid; clear wavy boundary.

IIC—55 to 72 inches; yellowish brown (10YR 5/4) loam; massive; friable; few roots; 5 percent fine gravel; slight effervescence (15 percent calcium carbonate); moderately alkaline.

The solum is 46 to 70 inches thick. The thickness of the solum commonly coincides with the depth to effervescent soil material. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. Reaction ranges from medium acid to neutral. The A2 horizon, where present, has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. Reaction ranges from medium acid to neutral. A B1t horizon is in some pedons. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam. It is strongly acid or medium acid. The IIB2 horizon has a color range similar to that of the B2 horizon. It is clay loam or loam in some pedons. It is very strongly acid to medium acid. The IIC horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is loam or sandy loam. It is mildly alkaline or moderately alkaline.

Sable series

The Sable series consists of deep, poorly drained, moderately permeable, nearly level to slightly depressional soils on uplands. These soils formed in silty loess. They are underlain by stratified outwash. Slopes range from 0 to 2 percent.

Sable soils are similar to Ragsdale soils and are commonly adjacent to Ipava and Tama soils on the landscape. Ragsdale soils have a silt loam surface layer and an argillic horizon. Ipava soils have an argillic horizon and generally have chroma of 2 to 4 in the B horizon. They occupy slightly higher positions on the landscape than Sable soils. Tama soils have an argillic horizon and do not have low-chroma mottles in the B2 horizon. They are gently sloping.

Typical pedon of Sable silty clay loam in a cultivated field 2,500 feet north and 150 feet west of the southeast corner of sec. 21, T. 19 N., R. 10 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam; moderate medium granular structure; firm; many fine roots; neutral; abrupt smooth boundary.

A12—10 to 19 inches; black (10YR 2/1) silty clay loam; moderate medium angular blocky structure; firm; many fine roots; neutral; clear smooth boundary.

B21g—19 to 32 inches; gray (10YR 5/1) silty clay loam; few medium distinct pale brown (10YR 6/3) and few fine distinct brownish yellow (10YR 6/6) mottles; moderate medium angular blocky structure; firm; common fine roots; common fine pores; many very dark gray (10YR 3/1) organic stains on faces of most peds; neutral; clear smooth boundary.

B22g—32 to 46 inches; light gray (10YR 6/1) silty clay loam; many medium distinct light gray (10YR 7/2) and few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; many very dark gray (10YR 3/1) organic stains on faces of some peds; neutral; clear smooth boundary.

B23g—46 to 54 inches; light gray (10YR 6/1) silty clay loam; few medium faint strong brown (7.5YR 5/8) and brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; few very dark grayish brown (10YR 3/2) organic stains on faces of some peds; neutral; clear wavy boundary.

C1g—54 to 62 inches; light gray (10YR 7/1) silt loam; few fine distinct strong brown (7.5YR 5/8) mottles; massive; friable; slight effervescence; mildly alkaline; clear smooth boundary.

IIC2—62 to 72 inches; light gray (10YR 7/1) stratified fine sand and coarse sand; single grained; loose; 5 percent fine gravel; strong effervescence; moderately alkaline.

The solum is 36 to 55 inches thick. The loess cap is 60 to 84 inches thick. The Ap or A12 horizon is black (10YR 2/1 or N 2/0). Reaction is slightly acid or neutral. The Bg horizon has hue of 2.5Y, 5Y, or 10YR; value of 4 to 6; and chroma of 2 or less. Mottles have hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 2 to 8. The C1g horizon is gray (10YR 5/1 or 6/1 or N 5/0 or 6/0) or light gray (10YR 7/1 or N 7/0). Mottles have hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 6 to 8. Reaction is neutral or mildly alkaline. The IIC2 horizon is gray (10YR 5/1 or 6/1 or N 5/0 or 6/0) or light gray (10YR 7/1 or N 7/0).

Shadeland series

The Shadeland series consists of moderately deep, somewhat poorly drained, moderately slowly permeable soils on terraces. These soils formed in thin layers of loess, glacial drift, and residuum weathered from stratified shale and sandstone. Slopes range from 0 to 2 percent.

Shadeland soils are commonly adjacent to Gosport and High Gap soils on the landscape. Gosport soils lack mottles in the upper part of the B horizon and are steep or very steep. High Gap soils lack mottles throughout the B horizon and are gently sloping.

Typical pedon of Shadeland silt loam, 0 to 2 percent slopes, in a cultivated area 500 feet east and 1,450 feet north of the southwest corner of sec. 28, T. 18 N., R. 10 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

A2—7 to 11 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium granular structure; friable; many roots; slightly acid; clear smooth boundary.

B21t—11 to 16 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium subangular blocky structure; firm; common roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of some peds; strongly acid; clear wavy boundary.

IIB22t—16 to 22 inches; yellowish brown (10YR 5/8) clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few roots; few fine pores; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of some peds; 5 percent gravel; strongly acid; clear wavy boundary.

IIIB3t—22 to 30 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of some peds; strongly acid; clear smooth boundary.

IIIC—30 to 35 inches; light brownish gray (10YR 6/2) very shaly clay loam; shale arranged in horizontal plates; few roots; strongly acid; abrupt smooth boundary.

IIIR—35 inches; hard sandstone.

The thickness of the solum ranges from 20 to 40 inches. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It does not occur in some cultivated areas. Reaction is slightly acid or neutral. The B2t horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. Mottles have hue of 10YR, value of 5 to 7, and chroma of 4 to 8. Reaction is medium acid or strongly acid. The IIB22t horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 8. It is mottled. It is medium acid or strongly acid. The IIIB3t horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. Mottles have hue of 10YR, value of 5 or 6, and chroma of 4 to 8. Reaction is medium acid or strongly acid. The R horizon is commonly sandstone or interbedded sandstone and shale.

Shipshe series

The Shipshe series consists of well drained soils that are moderately permeable or moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. These soils are on terraces. They are moderately deep over coarse sand and very gravelly coarse sand. They formed in glacial outwash. Slopes range from 0 to 6 percent.

Shipshe soils are similar to Fox soils and are commonly adjacent to Elston and Martinsville soils on the landscape. Fox soils lack a mollic epipedon and contain less gravel in the B horizon than Shipshe soils. Elston soils have a thicker solum than Shipshe soils and contain less gravel in the B horizon. Martinsville soils lack a mollic epipedon, have a thicker solum than Shipshe soils, and contain no gravel in the B horizon.

Typical pedon of Shipshe loam, 0 to 2 percent slopes (fig. 13), in a cultivated field 1,400 feet north and 2,400 feet west of the southeast corner of sec. 33, T. 18 N., R. 9 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many fine roots; 5 percent fine gravel; neutral; abrupt smooth boundary.

A12—8 to 14 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) rubbed, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many fine roots; 15 percent fine gravel; neutral; clear smooth boundary.

B1—14 to 20 inches; dark brown (10YR 3/3) very gravelly loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; many fine roots; common fine pores; 65 percent gravel; slightly acid; clear smooth boundary.

B21t—20 to 30 inches; dark reddish brown (5YR 3/3) very gravelly clay loam; moderate medium subangular blocky structure; firm; many medium roots; common medium pores; thin continuous very dark brown (10YR 2/2) clay films on faces of most peds; 60 percent gravel; medium acid; clear wavy boundary.

B22t—30 to 36 inches; dark yellowish brown (10YR 3/4) very gravelly clay loam; moderate medium subangular blocky structure; firm; many medium roots; common medium pores; thin continuous very dark brown (10YR 2/2) clay films on faces of most peds; 65 percent gravel and cobbles; medium acid; clear irregular boundary.

B23t—36 to 38 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam; weak medium subangular blocky structure; firm; many medium roots; few medium pores; thin continuous very dark brown (10YR 2/2) clay films on faces of most peds; 70 percent gravel; neutral; abrupt irregular boundary.

IIC—38 to 60 inches; brown (10YR 5/3) stratified very gravelly coarse sand and coarse sand; single grained; 70 percent gravel; slight effervescence (10 percent calcium carbonate); moderately alkaline.

The solum is 24 to 40 inches thick. The Ap horizon has hue of 7.5YR or 10YR, value of 2, and chroma of 1 or 2. The A12 horizon has hue of 10YR, value of 2, and chroma of 1 or 2. Texture ranges from sandy loam to silt loam. Reaction ranges from medium acid to neutral. The B2t horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 or 4; and chroma of 2 to 4. It ranges from gravelly loamy sand to very gravelly sandy clay loam. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6.

Shoals series

The Shoals series consists of deep, somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in loamy alluvial deposits. Slopes range from 0 to 2 percent.

Shoals soils are adjacent to Eel, Genesee, and Sloan soils on the landscape. Eel soils are mottled below a depth of 20 inches. Genesee soils have no mottles. Sloan soils have a mollic epipedon and have mottles in all horizons. They are in slightly depressional areas.

Typical pedon of Shoals silt loam in a cultivated field 2,000 feet north and 200 feet west of the southeast corner of sec. 33, T. 17 N., R. 10 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; many roots; neutral; abrupt smooth boundary.

C1—8 to 14 inches; dark brown (10YR 4/3) silt loam; few fine faint yellowish brown (10YR 4/4) mottles; moderate medium granular structure; friable; many roots; neutral; clear smooth boundary.

C2—14 to 24 inches; grayish brown (10YR 5/2) loam; many medium distinct dark brown (7.5YR 4/4) mottles; moderate medium granular structure; friable; common fine roots; neutral; clear smooth boundary.

C3—24 to 36 inches; grayish brown (10YR 5/2) loam; many medium distinct yellowish brown (10YR 5/8) and gray (10YR 5/1) mottles; moderate medium granular structure; friable; common fine roots; neutral; clear smooth boundary.

C4—36 to 60 inches; light brownish gray (10YR 6/2) loam; common medium distinct yellowish brown (10YR 5/6) and brown (10YR 5/3) mottles; moderate medium granular structure; friable; few fine roots; mildly alkaline; clear smooth boundary.

C5—60 to 72 inches; grayish brown (10YR 5/2) stratified silt loam, loam, and sandy loam; common medium distinct dark yellowish brown (10YR 4/4) and dark gray (10YR 4/1) mottles; massive; friable; slight effervescence (11 percent calcium carbonate); moderately alkaline.

Free carbonates are commonly below a depth of 30 inches but in some pedons are as shallow as 20 inches. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is commonly silt loam or loam. Reaction ranges from slightly acid to moderately alkaline. The C horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 2 or 3. It is mottled. It is dominantly silt loam or loam, but it ranges to sandy loam, light silty clay loam, or clay loam. Reaction ranges from neutral to moderately alkaline.

Sleeth series

The Sleeth series consists of deep, somewhat poorly drained, moderately permeable soils on terraces. These soils formed in loess and loamy glacial outwash and are underlain by stratified sand and gravelly sand. Slopes range from 0 to 2 percent.

Sleeth soils are similar to Whitaker soils and are commonly adjacent to Fox and Westland soils on the landscape. Whitaker soils are underlain by stratified sand and silt. Fox soils have no mottles in the B horizon and have a thinner solum than Sleeth soils. Westland soils have a silty clay loam surface layer and a mollic epipedon. They are in slightly depressional areas.

Typical pedon of Sleeth silt loam in a cultivated area 2,000 feet east and 800 feet north of the southwest corner of sec. 25, T. 17 N., R. 9 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

A2—7 to 11 inches; grayish brown (10YR 5/2) silt loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium granular structure; friable; many roots; neutral; clear smooth boundary.

IIB1t—11 to 17 inches; grayish brown (10YR 5/2) clay loam; many distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; common roots; few fine pores; few thin discontinuous brown (10YR 5/3) clay films on faces of some peds; slightly acid; clear smooth boundary.

IIB21t—17 to 22 inches; yellowish brown (10YR 5/6) clay loam; many medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few roots; few fine pores; thin grayish brown (10YR 5/2) clay films on faces of some peds; medium acid; clear smooth boundary.

IIB22t—22 to 34 inches; yellowish brown (10YR 5/8) clay loam; common medium distinct gray (10YR 6/1) and dark yellowish brown (10YR 4/4) mottles; moderate medium and coarse subangular blocky structure; firm; few roots; few fine pores; few thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of some peds; 5 percent fine gravel; medium acid; clear smooth boundary.

IIB23t—34 to 48 inches; dark grayish brown (10YR 4/2) gravelly clay loam; many medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few roots; few fine pores; few thin discontinuous dark brown (10YR 4/3) clay films on faces of some peds; 15 percent fine gravel; neutral; clear wavy boundary.

IIIC—48 to 60 inches; brown (10YR 5/3) sand and very gravelly sand; single grained; loose; few roots; 60 percent gravel; slight effervescence (8 percent calcium carbonate); moderately alkaline.

The solum is 40 to 60 inches thick. The loess cap is less than 20 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2. The B2 horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 to 8. It is silt loam, silty clay loam, clay loam, or gravelly clay loam. Reaction ranges from strongly acid to slightly acid. The C horizon has hue of 10YR, value of 3 to 6, and chroma of 1 to 4. It is gravelly loam, gravelly clay loam, gravelly sandy clay loam, sandy clay loam, or clay loam. Reaction ranges from neutral to moderately alkaline.

Sloan series

The Sloan series consists of deep, very poorly drained, moderately permeable soils on bottom land. These soils formed in loamy alluvial deposits. Slopes range from 0 to 2 percent.

Sloan soils are similar to Westland soils and are commonly adjacent to Eel and Shoals soils on the landscape. Westland soils are on terraces. They formed in silty or loamy material over stratified calcareous sand and gravel. Eel and Shoals soils differ from Sloan soils in having brighter colors in the solum and in lacking a mollic epipedon.

Typical pedon of Sloan loam in a pasture 100 feet south and 300 feet west of the northeast corner of sec. 6, T. 15 N., R. 9 W.

A11—0 to 3 inches; very dark gray (10YR 3/1) loam; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

A12—3 to 15 inches; very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B21g—15 to 29 inches; dark gray (10YR 4/1) silt loam; few fine distinct dark brown (10YR 4/3) mottles; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B22g—29 to 45 inches; dark gray (10YR 4/1) loam; few distinct dark yellowish brown (10YR 3/4) mottles; moderate medium granular structure; friable; few fine roots; neutral; clear smooth boundary.

IICg—45 to 60 inches; grayish brown (10YR 5/2) stratified sandy loam and loam; massive; friable; few fine roots; slight effervescence (14 percent calcium carbonate); moderately alkaline.

Sloan soils have a gleyed B horizon. Stratified, calcareous, medium textured alluvium is below a depth of about 45 inches. The A1 horizon has hue of 2.5Y or 10YR, value of 2 or 3, and chroma of 1 or 2. In some pedons the A horizon has hue of N and value of 2 or 3. The A12 horizon has hue of 10YR, value of 3 to 5, and chroma of 1 to 4. Texture ranges from loam to clay loam. The B2 horizon has hue of 5Y to 10YR, value of 4 or 5, and chroma of 1 or 2. It is mottled. It ranges from loam to clay loam. The C horizon has hue of 10YR, value of 3 to 5, and chroma of 2. It is mottled. It is stratified with sandy loam, loam, sand, and gravelly sand. Reaction is neutral to moderately alkaline.

Starks series

The Starks series consists of deep, somewhat poorly drained, moderately permeable or moderately slowly permeable soils on uplands. These soils formed in loess over loamy outwash. Slopes range from 0 to 2 percent.

Starks soils are similar to Reesville soils and are commonly adjacent to Fincastle and Ragsdale soils on the landscape. Reesville soils formed in loess and do not have a IIB horizon. In Fincastle soils the lower part of the B horizon formed in weathered glacial till. Ragsdale soils have a mollic epipedon and have a thick loess cap that extends to the lower part of the B horizon or to the C horizon. They are in slightly depressional areas.

Typical pedon of Starks silt loam in a cultivated field 1,300 feet south and 1,100 feet east of the northwest corner of sec. 31, T. 18 N., R. 9 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; common fine roots; many medium black (10YR 2/1) iron and manganese oxide concretions; slightly acid; abrupt smooth boundary.

A2—8 to 12 inches; dark brown (10YR 4/3) silt loam; weak medium platy structure; friable; few fine roots; discontinuous dark grayish brown (10YR 4/2) coatings on peds; many medium black (10YR 2/1) iron and manganese oxide concretions; medium acid; clear smooth boundary.

B21t—12 to 24 inches; dark brown (10YR 4/3) silty clay loam; many fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin continuous dark grayish brown (10YR 4/2) clay films on faces of most peds; strongly acid; clear smooth boundary.

B22t—24 to 38 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct brownish yellow (10YR 6/6) and very pale brown (10YR 7/3) mottles; moderate medium angular and subangular blocky structure; firm; few fine roots; few fine pores; thin gray (10YR 5/1) continuous clay films on faces of most peds; many fine black (10YR 2/1) iron and manganese oxide concretions; strongly acid; clear smooth boundary.

IIB23t—38 to 50 inches; grayish brown (10YR 5/2) sandy clay loam; many medium distinct light gray (10YR 7/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin gray (10YR 5/1) continuous clay films on faces of most peds; few fine black (10YR 2/1) iron and manganese oxide concretions; strongly acid; clear wavy boundary.

IIB3—50 to 62 inches; grayish brown (10YR 5/2) sandy clay loam and few bands of stratified silt; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium and coarse subangular blocky structure; firm; few fine roots; few fine pores; medium acid; abrupt smooth boundary.

IIC—62 to 72 inches; dark brown (10YR 4/3) loamy sand; single grained; very friable; medium acid.

The solum is 44 to 66 inches thick. The loess cap is 24 to 40 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is medium acid to slightly acid. The A2 horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. In some pedons it is mottled. The B horizon has hue of 10YR, value of 4 to 7, and chroma of 2 or 3. It is mottled. It ranges from sandy loam to clay loam. The C horizon is loamy outwash.

Stonelick series

The Stonelick series consists of deep, well drained, moderately rapidly permeable soils on bottom land. These soils formed in loamy alluvial deposits. Slopes range from 0 to 2 percent.

Stonelick soils are similar to Genesee soils and are commonly adjacent to Armiesburg soils. Genesee soils have a fine-loamy control section. Armiesburg soils have a mollic epipedon and contain more silt in the solum than Stonelick soils.

Typical pedon of Stonelick sandy loam in a cultivated area 500 feet north and 2,900 feet east of the southwest corner of sec. 26, T. 16 N., R. 9 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) sandy loam; weak fine granular structure; friable; common fine roots; mildly alkaline; abrupt smooth boundary.

C1—10 to 22 inches; yellowish brown (10YR 5/4) loamy sand; weak fine granular structure; very friable; few fine roots; neutral; clear smooth boundary.

C2—22 to 37 inches; dark brown (10YR 4/3) sandy loam; weak medium granular structure; very friable; few fine roots; mildly alkaline; gradual smooth boundary.

C3—37 to 54 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine granular structure; very friable; few fine roots; mildly alkaline; clear smooth boundary.

C4—54 to 72 inches; dark brown (10YR 4/3) fine sandy loam; single grained; loose; few fine roots; slight effervescence (10 percent calcium carbonate); moderately alkaline.

The weighted average of gravel in the control section ranges from 0 to 20 percent. The soil is dominantly mildly alkaline throughout, but in some pedons the upper part is neutral. The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. It is sandy loam, silt loam, or loam. The C horizon has hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is loam, sandy loam, or silt loam.

Tama series

The Tama series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in silty loess. Slopes range from 2 to 6 percent.

Tama soils are adjacent to Ipava and Sable soils on the landscape. Ipava soils have mottles throughout the B horizon. Sable soils do not have an argillic horizon. They have a silty clay loam surface layer and are underlain with loam glacial till, stratified outwash, and glacial drift.

Typical pedon of Tama silt loam, 2 to 6 percent slopes, in a cultivated field 1,400 feet west and 1,900 feet south of northeast corner of sec. 17, T. 19 N., R. 9 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—7 to 11 inches; very dark brown (10YR 2/2) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; many fine roots; neutral; clear smooth boundary.

A13—11 to 15 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) rubbed, gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

B1—15 to 19 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common fine roots; medium acid; gradual smooth boundary.

B21t—19 to 28 inches; brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; common roots; common fine pores; discontinuous thin brown (10YR 4/3) clay films on faces of most peds; medium acid; gradual wavy boundary.

B22t—28 to 38 inches; brown (10YR 5/3) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common roots; common fine pores; continuous thin brown (10YR 4/3) clay films on faces of most peds; few roots; very dark grayish brown (10YR 3/2) organic coatings on faces of some peds; few fine black (10YR 2/1) iron and manganese oxide concretions; slightly acid; abrupt smooth boundary.

B3—38 to 55 inches; pale brown (10YR 6/3) silt loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; few fine pores; very dark grayish brown (10YR 3/2) organic coatings on faces of some peds; few fine black (10YR 2/1) iron and manganese oxide concretions; slightly acid; abrupt smooth boundary.

C—55 to 72 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct light gray (10YR 7/2) mottles; massive; friable; few roots; very dark grayish brown (10YR 3/2) organic coatings on faces of some peds; slight effervescence (20 percent calcium carbonate); moderately alkaline.

The solum is 36 to 60 inches thick. The thickness of the solum coincides with the depth to effervescent material. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. The A horizon is strongly acid to slightly acid. The B1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is strongly acid to slightly acid. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is mottled. It is strongly acid to slightly acid. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or loam and is strongly acid to slightly acid.

Wea series

The Wea series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in loess and the underlying loamy glacial outwash. Slopes range from 0 to 2 percent.

Wea soils are similar to Shipshe soils and are commonly adjacent to Elston and Ockley soils on the landscape. Shipshe soils contain more gravel in the solum than Wea soils and have a thinner solum. The material in which Elston soils formed is more loamy and sandy than that in which Wea soils formed. Ockley soils do not have a mollic epipedon.

Typical pedon of Wea silt loam, 0 to 2 percent slopes (fig. 14), in a cultivated field 1,000 feet west and 2,000 feet south of the northeast corner of sec. 17, T. 18 N., R. 9 W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium and fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—7 to 16 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) rubbed, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

IIB1t—16 to 23 inches; very dark grayish brown (10YR 3/2) clay loam, dark brown (10YR 3/3) rubbed, dark brown (10YR 4/3) dry; moderate medium subangular blocky structure; firm; many fine roots; few fine pores; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of some peds; slightly acid; clear smooth boundary.

IIB21t—23 to 28 inches; dark brown (7.5YR 3/2) clay loam; weak medium subangular blocky structure; firm; many fine roots; common fine pores; thin continuous brown (7.5YR 3/2) clay films on faces of most peds; 5 percent gravel; medium acid; clear wavy boundary.

IIB22t—28 to 45 inches; dark brown (7.5YR 4/2) gravelly clay loam; moderate medium subangular blocky structure; firm; many fine roots; few fine pores; thin continuous dark brown (7.5YR 3/2) clay films on faces of some peds; 20 percent gravel; medium acid; clear wavy boundary.

IIB23t—45 to 56 inches; dark brown (7.5YR 4/4) very gravelly clay loam; weak medium subangular blocky structure; firm; common fine roots; few fine pores; thin continuous dark brown (7.5YR 3/2) clay films on faces of some peds; 50 percent gravel; slightly acid; gradual wavy boundary.

IIB3—56 to 59 inches; dark brown (7.5YR 3/2) very gravelly clay loam; weak medium subangular blocky structure; firm; few fine roots; few fine pores; 60 percent gravel; neutral; gradual wavy boundary.

C—59 to 72 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) sand and very gravelly sand; single grained; loose; 10 percent gravel; strong effervescence (25 percent calcium carbonate); moderately alkaline.

The solum is 40 to 60 inches thick. The Ap and A12 horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. They are silt loam or loam and are medium acid to neutral. The B2 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 6. Reaction ranges from neutral to moderately alkaline. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4.

Westland series

The Westland series consists of deep, very poorly drained, slowly permeable soils on terraces. These soils formed in loamy glacial drift or alluvium underlain by sand and gravelly sand. Slopes range from 0 to 2 percent.

Westland soils are similar to Sloan soils and are commonly adjacent to Ockley and Sleeth soils on the landscape. Sloan soils have a thinner solum than Westland soils. They formed in loamy alluvium on bottom land. Ockley soils do not have a mollic epipedon and are not mottled throughout the B horizon. Sleeth soils do not have a mollic epipedon. They are slightly higher on the landscape than Westland soils.

Typical pedon of Westland silty clay loam in a cultivated area 2,800 feet east and 1,400 feet north of the southwest corner of sec. 27, T. 17 N., R. 9 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) silty clay loam; moderate medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

A12—9 to 14 inches; very dark brown (10YR 2/2) silty clay loam; weak coarse subangular blocky structure parting to moderate medium granular; firm; many roots; neutral; clear smooth boundary.

B21t—14 to 18 inches; dark grayish brown (2.5Y 4/2) clay loam; common medium distinct light olive brown (2.5Y 5/6) and very dark gray (N 3/0) mottles; moderate medium subangular blocky structure; firm; common roots; common fine pores; 5 percent gravel; few thin discontinuous very dark gray (10YR 3/1) clay films on faces of some peds; neutral; clear wavy boundary.

IIB22t—18 to 24 inches; mottled dark grayish brown (10YR 4/2) and light olive brown (2.5Y 5/4 and 5/6) gravelly clay loam; moderate coarse subangular blocky structure; firm; common roots; common fine pores; 20 percent gravel; few thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of some peds; neutral; clear wavy boundary.

IIB23t—24 to 44 inches; very dark grayish brown (10YR 3/2) gravelly clay loam; common medium distinct light olive brown (2.5YR 5/4) and dark gray (10YR 4/1) mottles; moderate medium subangular blocky structure; firm; few roots; few fine pores; 20 percent gravel; few fine pores; 20 percent gravel; few thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of some peds; neutral; abrupt irregular boundary.

IIIC—44 to 60 inches; mottled very dark grayish brown (10YR 3/2), grayish brown (10YR 5/2), and very dark gray (N 3/0) coarse sand and very gravelly coarse sand; single grained; loose; 60 percent gravel; slight effervescence (8 percent calcium carbonate); moderately alkaline.

The solum is 40 to 60 inches thick. It is underlain by stratified, calcareous sand and gravelly sand. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. The B2 horizon has hue of 2.5Y or 10YR, value of 3 to 5, and chroma of 2 or less. It has few or common distinct mottles. It is clay loam, loam, sandy clay loam, gravelly clay loam, or loam. Reaction ranges from medium acid to neutral. The C horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. In some pedons it is dark gray (N 4/0) or very dark gray (N 3/0). Texture is loam, gravelly loam, or sand and gravel. Reaction is neutral or mildly alkaline.

Whitaker series

The Whitaker series consists of deep, somewhat poorly drained, moderately permeable soils on terraces. These soils formed in stratified silty and loamy outwash. Slopes range from 0 to 2 percent.

Whitaker soils are similar to Sleeth soils and are adjacent to Martinsville and Shoals soils. Sleeth soils contain more gravel in the lower part of the solum than Whitaker soils and contain gravel and sand in the C horizon. Martinsville soils do not have mottles in the B horizon. Shoals soils formed in alluvial material.

Typical pedon of Whitaker silt loam in a cultivated area 940 feet west and 100 feet south of the center of sec. 27, T. 17 N., R. 9 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A2—7 to 11 inches; grayish brown (10YR 5/2) silt loam; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium platy structure; friable; many fine roots; slightly acid; clear smooth boundary.

B1—11 to 15 inches; brown (10YR 4/3) silty clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; friable; many fine roots; thin discontinuous dark grayish brown (10YR 4/2) coatings on faces of some peds; medium acid; clear smooth boundary.

IIB21t—15 to 22 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct dark grayish brown (10YR 4/2) and light gray (10YR 7/2) mottles; moderate coarse subangular blocky structure; firm; common fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of most peds; strongly acid; clear smooth boundary.

IIB22t—22 to 35 inches; light brownish gray (10YR 5/2) clay loam; many medium distinct yellowish brown (10YR 5/4 to 5/6) and brown (10YR 5/3) mottles; moderate coarse prismatic structure; firm; common fine roots; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of some peds; strongly acid; clear smooth boundary.

IIB3—35 to 52 inches; brown (10YR 5/3) loam; few fine distinct brownish yellow (10YR 6/6) and dark grayish brown (10YR 4/2) mottles; moderate coarse prismatic structure; friable; few fine roots; slightly acid; clear wavy boundary.

IIC—52 to 72 inches; dark grayish brown (10YR 4/2) stratified silt loam and sandy loam; many medium distinct dark yellowish brown (10YR 3/4) and yellowish brown (10YR 5/6) mottles; massive; friable; few roots; neutral.

The solum is 36 to 60 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 3. It is loam or silt loam. The B1 horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It has common to many distinct mottles. Reaction ranges from strongly acid to slightly acid. The B2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is mottled. It is commonly clay loam but ranges from loam to silty clay loam. Reaction ranges from strongly acid to slightly acid. The IIB3 horizon is similar to the IIB2 horizon. The IIC horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. It is mottled. It is commonly silt loam, loam, or sandy loam. Reaction ranges from neutral to moderately alkaline.

Xenia series

The Xenia series consists of deep, moderately well drained, moderately slowly permeable soils on uplands. These soils formed in loess and the underlying loamy glacial till. Slopes range from 1 to 4 percent.

Xenia soils are similar to Dana soils and are commonly adjacent to Fincastle and Russell soils. Dana soils have a mollic epipedon. Fincastle soils have mottles throughout the B horizon and are nearly level, and Russell soils have no mottles in the B horizon. Dana, Fincastle, and Russell soils have a IIB horizon that formed in loamy glacial till.

Typical pedon of Xenia silt loam, 1 to 4 percent slopes, in a cultivated field 1,600 feet north and 100 feet west of the southeast corner of sec. 13, T. 15 N., R. 10 W.

Ap—0 to 8 inches; dark yellowish brown (10YR 3/4) silt loam; moderate medium granular structure; friable; many fine roots; neutral; clear smooth boundary.

A2—8 to 12 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; friable; many fine roots; neutral; clear smooth boundary.

B21t—12 to 18 inches; yellowish brown (10YR 5/4) and pale brown (10YR 5/3) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; few fine pores; thin discontinuous very pale brown (10YR 7/3) clay films on faces of some peds; medium acid; clear smooth boundary.

B22t—18 to 28 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct light brownish gray (10YR 6/2) and light gray (10YR 7/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; few fine pores; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of some peds; strongly acid; clear smooth boundary.

IIB23t—28 to 34 inches; yellowish brown (10YR 5/6) clay loam; many medium distinct light brownish gray (10YR 6/2) and light gray (10YR 7/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; few fine pores; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of peds; common fine dark iron and manganese oxide concretions; strongly acid; abrupt smooth boundary.

IIB3t—34 to 52 inches; yellowish brown (10YR 5/4) clay loam; many fine and medium distinct pale brown (10YR 6/3) and light gray (10YR 7/1) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; thin discontinuous dark brown (10YR 4/3) clay films on faces of some peds; medium acid; abrupt irregular boundary.

IIC—52 to 72 inches; brown (10YR 5/3) loam; many medium distinct pale brown (10YR 6/3) and grayish brown (10YR 5/2) mottles; massive; firm; few roots; 5 percent fine gravel; slight effervescence (13 percent calcium carbonate); moderately alkaline.

The solum is 46 to 56 inches thick. The thickness of the solum commonly coincides with the depth to effervescent material. The loess cap is 22 to 40 inches thick. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. Reaction ranges from medium acid to neutral. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Reaction ranges from medium acid to neutral. A thin B1 horizon is in some pedons. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is mottled. The IIB3 horizon has the same color range as the B2 horizon. It is clay loam or loam. It is commonly slightly acid or neutral, but in some pedons the upper part is medium acid. The IIC horizon has hue of 10YR, value of 5 or 6, and chroma of 3. It is mottled. It is loam or clay loam. Reaction is mildly alkaline or moderately alkaline.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*5*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Hapludalfs (*Hapl*, meaning simple horizons, plus *udalf*, the suborder of Alfisols that have a udic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceeding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

In this secton the major factors of soil formation and their effect on the soils in the county are described.

Factors of soil formation

Soil is the product of soil-forming processes acting on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil that has distinct horizons. The length of time varies, but some time is always required for differentiation of soil horizons. Generally, a long time is required for distinct horizons to form.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent material

Parent material is the unconsolidated mass in which a soil forms. The parent material of most of the soils of Vermillion County was deposited by glaciers or by melt water from glaciers, or it was carried by the wind and deposited as loess. Some of the material is reworked and redeposited by subsequent actions of water and wind. The glaciers covered the county about 15,000 to 20,000 years ago. Parent material determines the limits of the chemical and mineralogical composition of the soil. Even if parent materials are of common glacial origin, soil properties vary greatly, sometimes within small areas, depending on how the material was deposited. The dominant parent materials in Vermillion County are Pennsylvanian age sandstone and shale, Wisconsin age glacial till, loess and outwash deposits, recent alluvium, and organic material.

Glacial till is material laid down directly by glaciers with a minimum of water action. It consists of particles of different sizes that are mixed together. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by washing water. The glacial till in Vermillion County is calcareous. It is mainly loam, but in a few areas it is clay loam. Miami soils formed in glacial till.

Loess is dominantly silt-size material that was carried by wind. Loess was deposited in the entire upland area of Vermillion County during the Wisconsin glacial period. This mantle of loess ranges from a few inches to several feet in thickness. Alford, Ipava, Ragsdale, Reesville, and Tama soils formed in loess.

Outwash material was deposited by running water from melting glaciers. The size of particles that make up outwash material varies according to the velocity of the water. When fast moving water slows down, the coarser particles are deposited. Finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers that differ in particle size distribution, such as sandy loam, sand, and gravel. Fox and Shipshe soils formed in deposits of outwash material.

In a few areas, mainly along the Big Vermillion and Wabash Rivers, sandstone and shale bedrock are above a depth of 20 to 40 inches. It is mainly on breaks between the terraces and uplands. The soils in these areas formed in thin deposits of loess or glacial drift and in residuum derived from sandstone and shale. Gosport, High Gap, and Shadeland soils are examples.

Alluvial material was redeposited by the floodwater of present streams in recent time. This material varies in texture, depending on the source and speed of the floodwater. Alluvium deposited along a swift stream, such as the Wabash River, is coarser textured than that deposited along a slow, sluggish stream, such as Feather Creek. Armiesburg and Genesee soils are alluvial.

Organic material is made up of plant remains. After the glaciers withdrew from the area, water was left standing in depressions in outwash plains, lake plains, and till plains. Grasses and sedges growing around the edges of these lakes died, and their remains fell to the bottom. Because of the wetness of the area, the plant remains did not decompose. Later, water-tolerant trees grew in the area. As these trees died, their residue became a part of the organic accumulation. The lakes were eventually filled with organic material and developed into areas of muck and peat. In most of these areas, the plant remains subsequently decomposed. Palms soils formed in organic material.

Plant and animal life

Plants have been the principal organisms influencing the soils in Vermillion County, but bacteria, fungi, earthworms, and man have also been important. The chief contribution of plants and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kind of plants that grew on the soil. The remains of these plants accumulate on the surface, decay, and eventually become organic matter. Roots of the plants provide channels for the downward movement of water through the soil and also add organic matter as they decay. Bacteria help to break down the organic matter so that it can be used by growing plants.

The native vegetation in Vermillion County was mainly deciduous forest and prairie. Differences in natural soil drainage and minor changes in parent material have affected the composition of the forest species.

The soils that formed dominantly under forest generally contain less organic matter than the soils that formed dominantly under grass. In general, the well drained soils, such as Ockley and Russell soils, were covered with sugar maple, beech, ash, hickory, oak, and poplar. The wet soils supported primarily sweetgum, elm, and oak. Ragsdale and Westland soils formed under wet conditions and contain a large amount of organic matter.

Climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil and the amount of available water that weathers minerals and transports soil material. Through its influence on temperatures in the soil, climate also determines the rate of chemical reaction that occurs in the soil.

The climate in Vermillion County is cool and humid. The soils in the county differ from soils that formed in a dry, warm climate and from those that formed in a hot, moist climate. Climate is uniform throughout the county, but the microclimate of the soil is modified locally by runoff. Therefore, the differences in the soils of Vermillion County, to a minor extent, are the results of differences in climate. More detailed information on the climate of this county is given in the section "General nature of the county."

Relief

Relief, or lay of the land, has a marked influence on the soils of Vermillion County through its effect on natural drainage, erosion, plant cover, and soil temperature. Slopes range from 0 to 70 percent. The soils range from excessively drained on the ridgetops to very poorly drained in the depressions.

Relief influences the formation of soils by affecting runoff and natural soil drainage; drainage in turn, through its affect on aeration of the soil, determines the color of the soil. Runoff is most rapid on the steeper slopes, whereas in low areas water is temporarily ponded. Water and air move freely through well drained soils but slowly through very poorly drained soils. In well aerated soils, the iron compounds that give most soils their color are oxidized and brightly colored. Poorly aerated soils are dull gray and mottled. Russell soils are well drained and well aerated, whereas Ragsdale soils are very poorly drained and poorly aerated.

Time

Time, generally a long time, is required for the agents of soil formation to form distinct soil horizons from parent material. Differences in the length of time that parent material has been in place are commonly reflected in the degree of development of the soil profile. Some soils form rapidly, others slowly.

The soils in Vermillion County range from young to mature. The glacial deposits in which many of the soils in Vermillion County formed have been exposed to soil-forming factors for a long enough time to allow distinct horizons to form within the soil profile. Some soils, however, are forming in recent alluvial sediments and have not been in place long enough for distinct horizons to be evident.

Genesee soils are young soils that formed in alluvial material. Russell and Xenia soils show the effect of time on leaching of lime from the soil. The solum formerly had about the same amount of lime as the C horizon has today, but the lime has been leached to a depth of about 50 inches.

Processes of soil formation

Several processes have been involved in the formation of the soils in this county. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; the liberation and translocation of silicate clay minerals; and the reduction and transfer of iron. In most soils, more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all soils. The organic-matter content of some soils is low, but that of others is high. Generally, the soils that contain the most organic matter, such as Ragsdale and Sable soils, have a thick, black surface horizon.

Carbonates and bases have been leached from the upper horizons of nearly all the soils. Leaching probably precedes the translocation of silicate clay minerals. Almost all of the carbonates and some of the bases have been leached from the A and B horizons of well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by acid reaction. Leaching of wet soils is slow because the water table is high or because water moves slowly through these soils.

Clay particles accumulate in pores and other voids and form films on the surfaces along which water moves. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils of this county. In Miami soils, for example, translocated silicate clays in the form of clay films have accumulated in the B2t horizon.

The reduction and transfer of iron, or gleying, has occurred in all of the very poorly drained and somewhat poorly drained soils in the county. In the naturally wet soils, this process has significantly affected horizon differentiation. The gray color of the subsoil indicates the redistribution of iron oxides. The reduction is commonly accompanied by some transfer of iron, either from upper horizons to lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate the segregation of iron.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May,* for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse* more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Illustrations

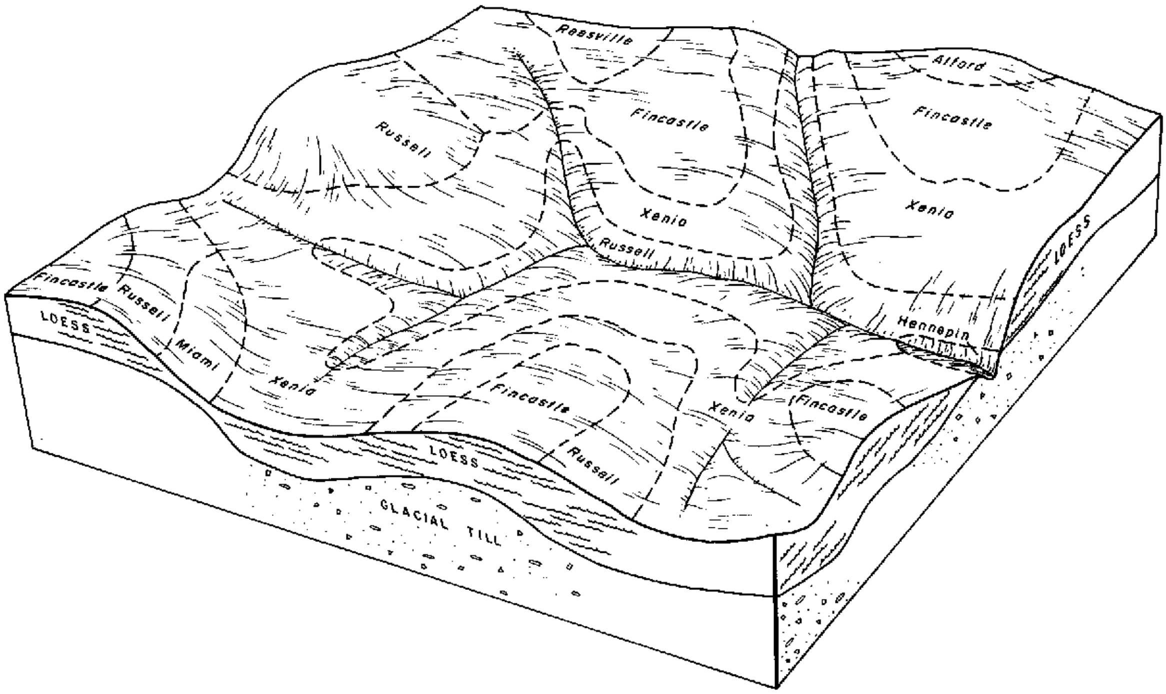

Figure 1.—Pattern of soils and underlying material in the Xenia-Russell-Fincastle map unit.

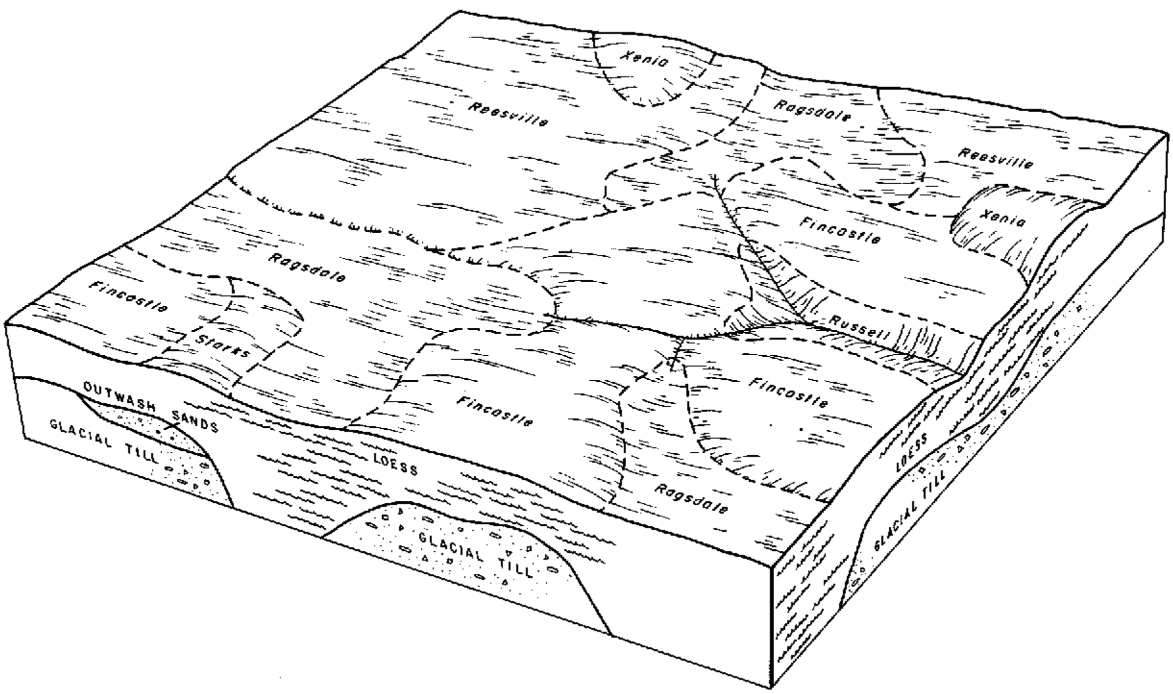

Figure 2.—Pattern of soils and underlying material in the Reesville-Ragsdale-Fincastle map unit.

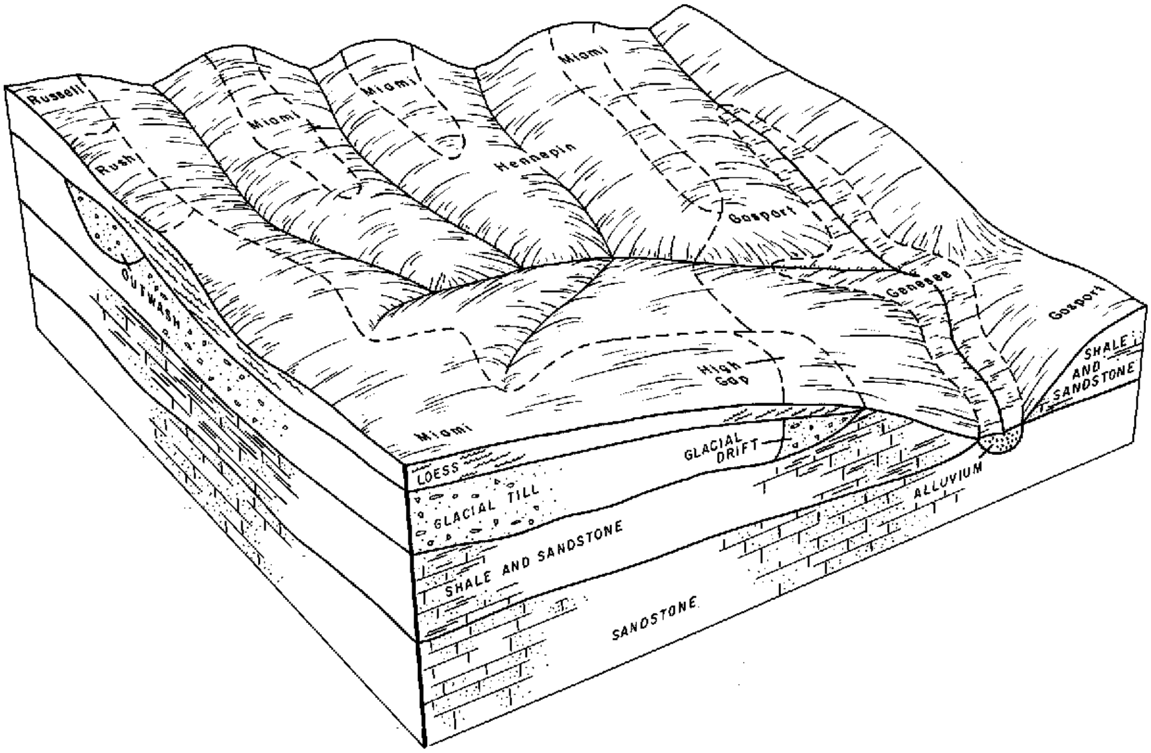

Figure 3.—Pattern of soils and underlying material in the Hennepin-Miami map unit.

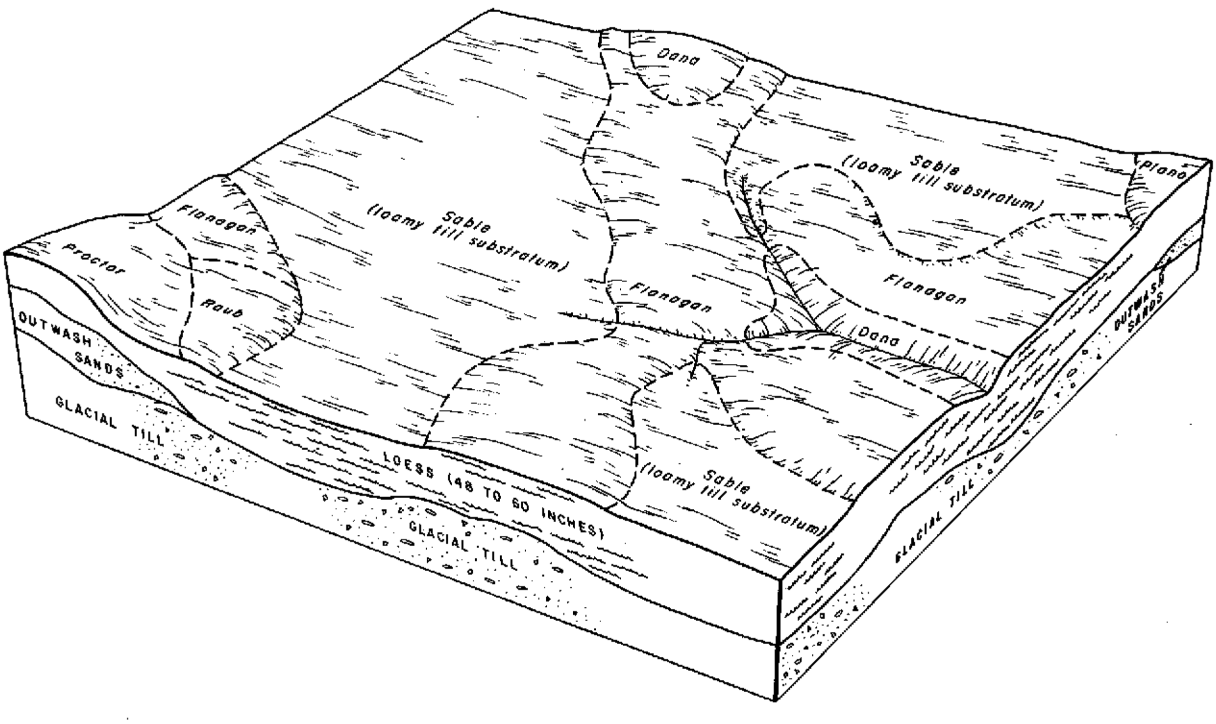

Figure 4.—Pattern of soils and underlying material in the Sable-Flanagan map unit.

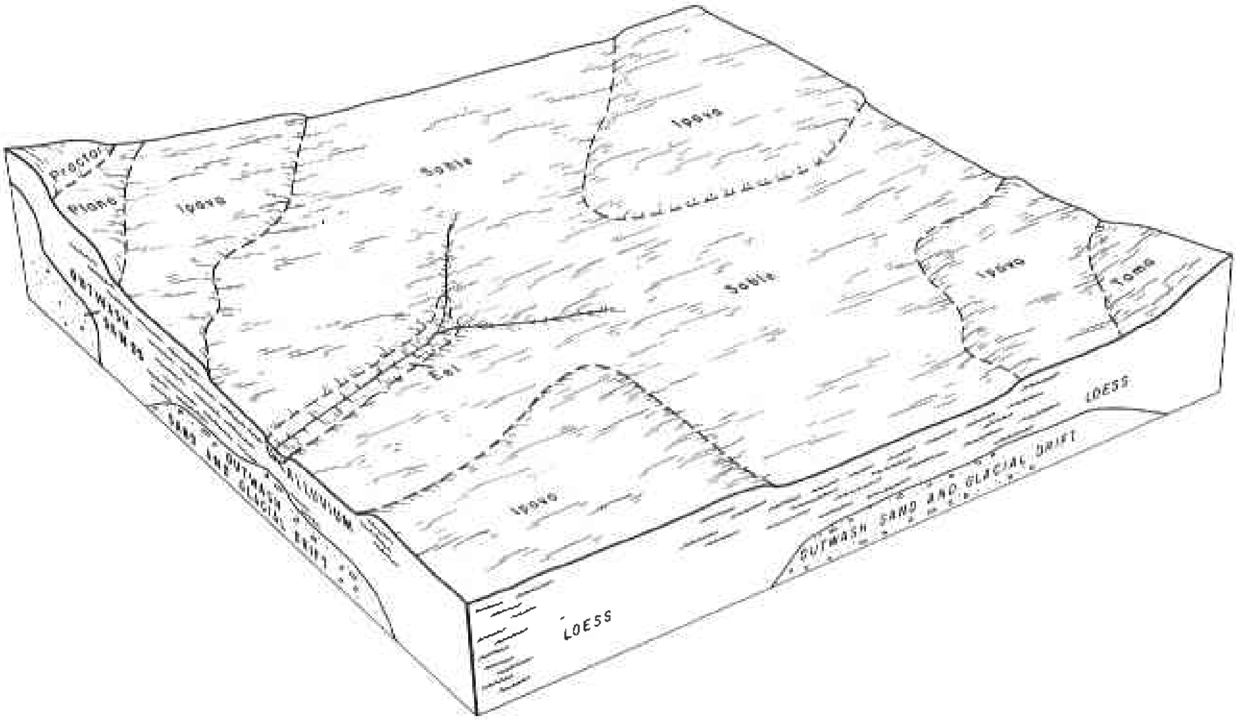

Figure 5.—Pattern of soils and underlying material in the Sable-Ipava map unit.

Figure 6.—Typical area of Genesee silt loam.

Figure 7.—Wooded area of Gosport shaly silt loam, 50 to 70 percent slopes.

Figure 8.—Wooded area of Hennepin loam, 25 to 50 percent slopes.

Figure 9.—A stand of pine and hardwoods in an area of Orthents, loamy, 33 to 90 percent slopes. The strip mine lake has been stocked with fish.

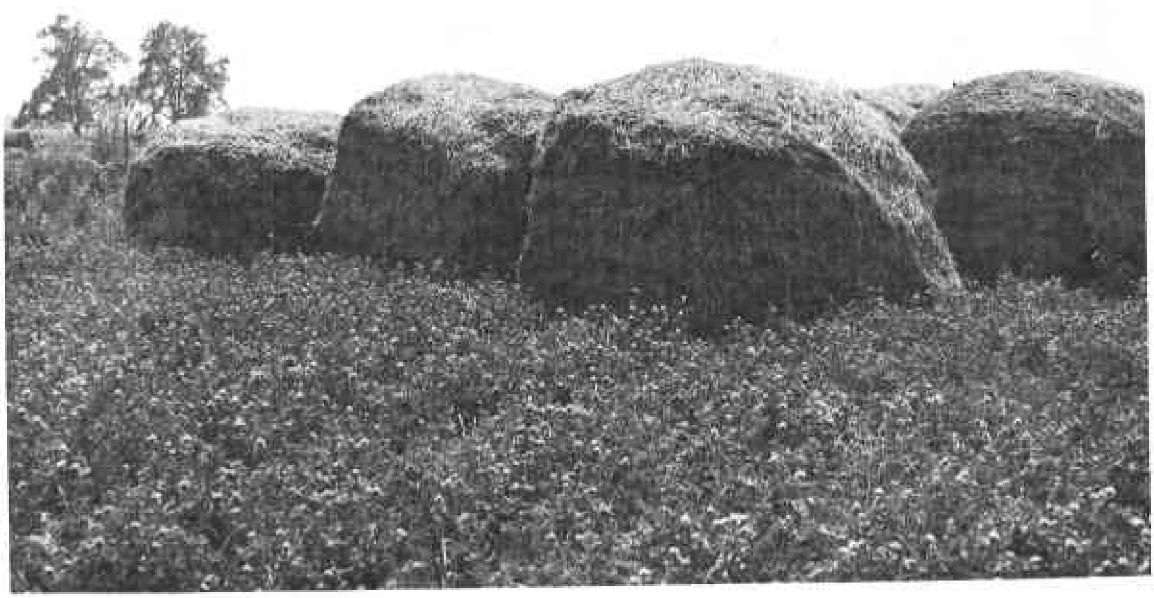

Figure 10.—Large bales of grass-legume hay on Raub silt loam, 0 to 2 percent slopes.

Figure 11.—Cattle grazing a grass-legume pasture in a broad area of Shipshe loam, 0 to 2 percent slopes.

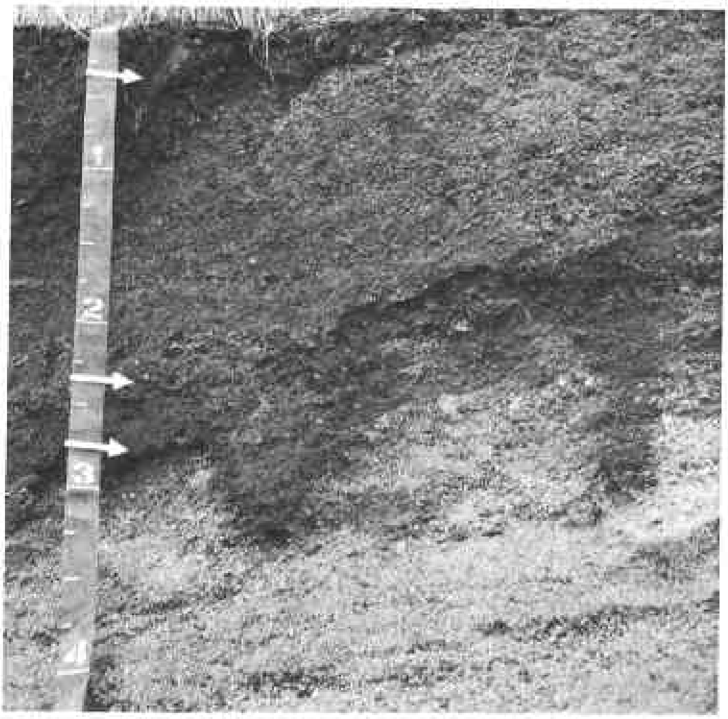

Figure 12.—Profile of Fox loam, 0 to 2 percent slopes. The underlying material is at a depth of 24 to 40 inches.

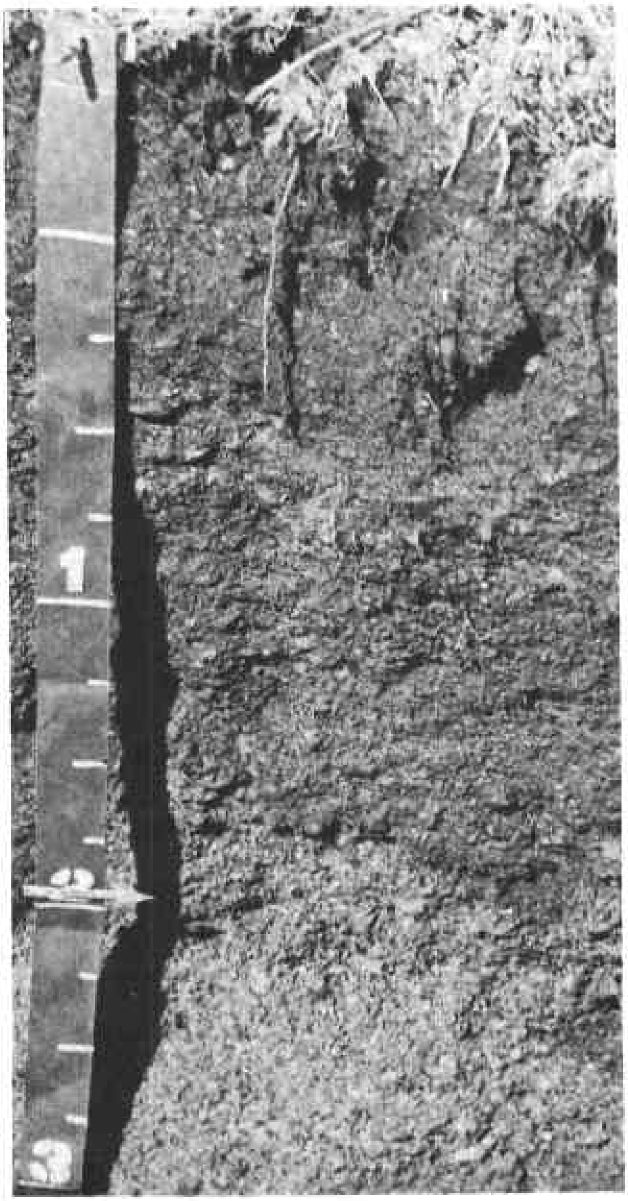

Figure 13.—Profile of Shipshe loam, 0 to 2 percent slopes. The underlying material is below a depth of 24 inches.

Figure 14.—Profile of Wea silt loam, 0 to 2 percent slopes. The content of gravel is high at the lower depths.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data are from Rockville, Ind.]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	2 years in 10 will have at least 5 days with-- Maximum temperature equal to or higher than--	2 years in 10 will have at least 5 days with-- Minimum temperature equal to or lower than--	Average total	1 year in 10 will have-- Less than--	1 year in 10 will have-- More than--	Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover of 1 inch or more
	°F	°F	°F	°F	In	In	In		In
January----	37	20	59	-4	2.7	0.6	5.8	8	2.4
February---	40	23	62	1	2.4	0.6	4.4	6	2.7
March------	50	31	73	12	3.5	1.5	7.9	2	3.9
April------	64	43	82	26	4.1	1.9	6.9	0.1	2.2
May--------	76	50	88	34	4.6	1.8	9.0	0	0
June-------	84	61	94	44	4.9	1.7	9.8	0	0
July-------	87	64	96	52	3.8	1.6	7.2	0	0
August-----	85	63	95	49	3.1	1.4	5.2	0	0
September--	79	55	92	39	3.0	0.9	5.2	0	0
October----	68	45	85	28	2.9	0.8	6.9	0	0
November---	52	33	71	15	3.2	1.3	5.4	1	2.0
December---	40	24	62	3	2.9	0.9	6.5	8	2.6
Year---	64	43	1/98	2/-7	41.1	35.0	50.4	25.1	2.6

1/Average annual highest temperature.
2/Average annual lowest temperature.

TABLE 2.--PROBABILITIES OF LAST FREEZING TEMPERATURES IN SPRING AND FIRST IN FALL

[Data are from Veedersburg and Rockville, Ind.]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than--	Mar. 25	Apr. 3	Apr. 14	May 11	May 16
2 years in 10 later than--	Mar. 18	Mar. 28	Apr. 8	Apr. 23	May 7
5 years in 10 later than--	Mar. 5	Mar. 17	Mar. 26	Apr. 11	Apr. 28
Fall:					
1 year in 10 earlier than--	Nov. 14	Oct. 28	Oct. 25	Oct. 7	Sep. 30
2 years in 10 earlier than--	Nov. 20	Nov. 7	Oct. 29	Oct. 19	Oct. 5
5 years in 10 earlier than--	Dec. 2	Nov. 19	Nov. 7	Oct. 29	Oct. 15

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AlB2	Alford silt loam, 2 to 6 percent slopes, eroded	670	0.4
AlC2	Alford silt loam, 6 to 12 percent slopes, eroded	300	0.2
Ar	Armiesburg silty clay loam	4,110	2.4
DaB	Dana silt loam, 1 to 4 percent slopes	1,350	0.8
Dm	Dumps, mine	230	0.1
Ee	Eel silt loam	2,200	1.3
EoA	Elston sandy loam, 0 to 2 percent slopes	2,650	1.6
EoB	Elston sandy loam, 2 to 6 percent slopes	1,010	0.6
FcA	Fincastle silt loam, 0 to 2 percent slopes	11,440	6.8
FgA	Flanagan silt loam, 0 to 2 percent slopes	4,680	2.8
FoB2	Fox sandy loam, 2 to 6 percent slopes, eroded	2,430	1.4
FoC2	Fox sandy loam, 6 to 12 percent slopes, eroded	590	0.4
FsA	Fox loam, 0 to 2 percent slopes	4,290	2.5
FxC3	Fox clay loam, 6 to 12 percent slopes, severely eroded	420	0.2
Ge	Genesee silt loam	12,150	7.2
GpG	Gosport shaly silt loam, 50 to 70 percent slopes	670	0.4
HeF	Hennepin loam, 25 to 50 percent slopes	12,860	7.6
HgB	High Gap silt loam, 2 to 6 percent slopes	310	0.2
IpA	Ipava silt loam, 0 to 2 percent slopes	4,410	2.6
McA	Martinsville loam, 0 to 2 percent slopes	950	0.6
McB2	Martinsville loam, 2 to 6 percent slopes, eroded	540	0.3
MeD2	Miami silt loam, 12 to 18 percent slopes, eroded	1,180	0.7
MsC3	Miami clay loam, 6 to 12 percent slopes, severely eroded	1,690	1.0
MsD3	Miami clay loam, 12 to 18 percent slopes, severely eroded	550	0.3
OcA	Ockley silt loam, 0 to 2 percent slopes	2,320	1.4
OcB	Ockley silt loam, 2 to 6 percent slopes	730	0.4
OrB	Orthents, loamy, 0 to 8 percent slopes	3,660	2.2
OrG	Orthents, loamy, 33 to 90 percent slopes	2,400	1.4
Pa	Palms muck	220	0.1
Pg	Pits, gravel	970	0.6
PlA	Plano silt loam, 0 to 2 percent slopes	520	0.3
PrC	Princeton fine sandy loam, 8 to 15 percent slopes	360	0.2
PtA	Proctor silt loam, 0 to 2 percent slopes	340	0.2
PtB	Proctor silt loam, 2 to 6 percent slopes	760	0.5
Ra	Ragsdale silt loam	12,435	7.4
RbA	Raub silt loam, 0 to 2 percent slopes	1,530	0.9
ReA	Reesville silt loam, 0 to 2 percent slopes	12,920	7.7
RoF	Rodman gravelly loam, 25 to 50 percent slopes	1,530	0.9
RtA	Rush silt loam, 0 to 2 percent slopes	400	0.2
RtB2	Rush silt loam, 2 to 6 percent slopes, eroded	680	0.4
RuB2	Russell silt loam, 2 to 6 percent slopes, eroded	6,030	3.6
RuC2	Russell silt loam, 6 to 12 percent slopes, eroded	4,280	2.5
Sa	Sable silty clay loam	5,576	3.3
Sb	Sable silty clay loam, loamy till substratum	8,074	4.8
SeA	Shadeland silt loam, 0 to 2 percent slopes	170	0.1
SgA	Shipshe loam, 0 to 2 percent slopes	5,280	3.1
SgB	Shipshe loam, 2 to 6 percent slopes	910	0.5
Sh	Shoals silt loam	3,800	2.3
Sm	Sleeth silt loam	340	0.2
Sn	Sloan loam	710	0.4
So	Starks silt loam	690	0.4
Sp	Stonelick sandy loam	1,760	1.0
TaB	Tama silt loam, 2 to 6 percent slopes	730	0.4
WeA	Wea silt loam, 0 to 2 percent slopes	740	0.4
Wt	Westland silty clay loam	430	0.3
Wx	Whitaker silt loam	280	0.2
XeB	Xenia silt loam, 1 to 4 percent slopes	13,430	8.0
	Water	1,635	1.0
	Total	168,320	100.0

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1976. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
AlB2 Alford	120	42	48	4.0	8.0
AlC2 Alford	110	38	44	3.6	7.2
Ar Armiesburg	85	37	40	3.0	8.8
DaB Dana	130	46	52	4.3	8.6
Dm**. Dumps					
Ee Eel	85	32	---	3.0	8.0
EoA Elston	90	32	40	3.0	6.0
EoB Elston	90	32	40	3.0	6.0
FcA Fincastle	130	46	52	4.3	8.6
FgA Flanagan	141	47	58	5.5	---
FoB2 Fox	80	30	42	3.0	---
FoC2 Fox	70	28	38	2.5	---
FsA Fox	90	32	45	3.0	---
FxC3 Fox	70	---	35	2.3	---
Ge Genesee	85	32	---	3.0	8.0
GpG Gosport	---	---	---	---	---
HeF Hennepin	---	---	---	1.9	---
HgB High Gap	85	32	45	3.0	6.0
IpA Ipava	145	50	57	5.3	---
McA Martinsville	120	42	48	4.0	8.0
McB2 Martinsville	115	40	46	3.8	7.6

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
MeD2----------------------- Miami	80	28	36	2.6	5.2
MsC3----------------------- Miami	90	32	40	3.0	6.0
MsD3----------------------- Miami	---	---	---	2.5	5.0
OcA------------------------ Ockley	110	38	44	3.6	7.2
OcB------------------------ Ockley	110	38	44	3.6	7.2
OrB, OrG**. Orthents					
Pa------------------------- Palms	105	42	---	---	---
Pg**. Pits					
PlA------------------------ Plano	135	48	55	5.5	---
PrC------------------------ Princeton	90	32	36	2.6	5.2
PtA------------------------ Proctor	130	45	51	5.0	---
PtB------------------------ Proctor	130	45	51	4.9	---
Ra------------------------- Ragsdale	155	54	62	5.1	10.2
RbA------------------------ Raub	140	49	56	4.6	9.2
ReA------------------------ Reesville	135	47	54	4.5	---
RoF------------------------ Rodman	---	---	---	---	0.2
RtA------------------------ Rush	125	44	50	4.1	8.2
RtB2----------------------- Rush	120	42	48	4.0	8.0
RuB2----------------------- Russell	115	40	46	3.8	7.6
RuC2----------------------- Russell	105	37	42	3.4	6.8
Sa------------------------- Sable	157	56	64	5.1	---
Sb------------------------- Sable	155	54	62	5.0	---
SeA------------------------ Shadeland	95	35	50	3.3	6.6
SgA------------------------ Shipshe	85	32	40	3.0	6.0

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
SgB: Shipshe	85	32	40	3.0	6.0
Sh: Shoals	80	32	33	3.0	8.0
Sm: Sleeth	120	42	48	4.0	8.0
Sn: Sloan	---	---	---	---	---
So: Starks	135	47	54	4.6	---
Sp: Stonelick	80	25	35	3.5	---
TaB: Tama	130	45	52	5.2	---
WeA: Wea	120	42	48	4.0	8.0
Wt: Westland	140	49	56	4.6	9.2
Wx: Whitaker	130	46	52	4.3	8.6
XeB: Xenia	120	42	48	4.0	8.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

** See map unit description for the composition and behavior of the map unit.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY

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

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Important trees	Site index	
AlB2, AlC2: Alford	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
Ar: Armiesburg	1o	Slight	Slight	Slight	Slight	Yellow-poplar White oak Black walnut	100 90 70	Eastern white pine, black walnut, yellow-poplar, black locust.
DaB: Dana	---	---	---	---	---	---	---	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
Ee: Eel	1o	Slight	Slight	Slight	Slight	Yellow-poplar Eastern cottonwood White ash Black walnut	100 --- --- ---	Eastern white pine, black walnut, yellow-poplar, black locust.
FcA: Fincastle	3o	Slight	Slight	Slight	Slight	Northern red oak White oak Pin oak Yellow-poplar Sweetgum	75 75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
FgA: Flanagan	---	---	---	---	---	---	---	Black walnut, eastern cottonwood, green ash, yellow-poplar, eastern white pine.
FoB2, FoC2, FsA, FxC3: Fox	1o	Slight	Slight	Slight	Slight	Northern red oak White oak Sugar maple	80 --- ---	Yellow-poplar, white ash, eastern white pine, red pine, black locust.
Ge: Genesee	1o	Slight	Slight	Slight	Slight	Yellow-poplar	100	Eastern white pine, black walnut, yellow-poplar, black locust.
GpG: Gosport	5d	Moderate	Moderate	Moderate	Moderate	White oak	45	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, poplar.
HeF: Hennepin	1r	Severe	Severe	Slight	Slight	Northern red oak White oak	85 ---	Northern red oak, white oak, green ash, black walnut, eastern white pine, red pine, eastern redcedar.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Important trees	Site index	Trees to plant
HgB: High Gap	3o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Virginia pine	75 75 55	Eastern white pine, red pine, Virginia pine.
IpA: Ipava	---	---	---	---	---	---	---	Black walnut, eastern cottonwood, yellow-poplar, white oak, green ash, American sycamore.
McA, McB2: Martinsville	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
MeD2, MsC3, MsD3: Miami	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
OcA, OcB: Ockley	1o	Slight	Slight	Slight	Slight	White oak Northern red oak Yellow-poplar Sweetgum	90 90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
Pa: Palms	4w	Slight	Severe	Severe	Severe	Red maple Silver maple White ash Quaking aspen	46 --- --- ---	
PlA: Plano	---	---	---	---	---	---	---	Black walnut, eastern white pine, red pine, green ash, northern red oak.
PrC: Princeton	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
PtA, PtB: Proctor	---	---	---	---	---	---	---	Black walnut, green ash, red maple, eastern white pine, red pine, Scotch pine.
Ra: Ragsdale	2w	Slight	Severe	Severe	Severe	Pin oak White oak Sweetgum	90 75 90	Eastern white pine, baldcypress, Norway spruce, red maple, white ash, sweetgum.
RbA: Raub	---	---	---	---	---	---	---	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns: Erosion hazard	Management concerns: Equip- ment limita- tion	Management concerns: Seedling mortal- ity	Management concerns: Wind- throw hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
ReA------------------ Reesville	3o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Sugar maple---------	75 85 90	Eastern white pine, white ash, red maple.
RoF------------------ Rodman	3s	Severe	Severe	Severe	Slight	Northern red oak---- White oak----------- Red pine------------ Eastern white pine--	70 70 75 85	Eastern white pine, red pine, jack pine.
RtA, RtB2------------ Rush	1o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Yellow-poplar------- Sweetgum------------	90 90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
RuB2, RuC2----------- Russell	1o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Yellow-poplar------- Sweetgum------------	90 90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.
Sa------------------- Sable	---	--------	--------	--------	--------	--------------------	---	Pin oak, green ash, European larch, eastern cottonwood.
Sb------------------- Sable	---	--------	--------	--------	--------	--------------------	---	Eastern cottonwood, American sycamore, red maple, green ash, pin oak, sweetgum.
SeA------------------ Shadeland	3o	Slight	Slight	Slight	Slight	White oak----------- Pin oak------------- Yellow-poplar------- Sweetgum------------	75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
SgA, SgB------------- Shipshe	---	--------	--------	--------	--------	--------------------	---	Eastern white pine, Norway spruce, red pine, black walnut, white ash.
Sh------------------- Shoals	2o	Slight	Slight	Slight	Slight	Pin oak------------- Sweetgum------------ Yellow-poplar------- Virginia pine------- Eastern cottonwood-- White ash-----------	90 85 90 90 --- ---	Sweetgum, red maple, swamp chestnut oak, pin oak, yellow-poplar.
Sm------------------- Sleeth	3o	Slight	Slight	Slight	Slight	Pin oak------------- Yellow-poplar------- Sweetgum------------ White oak-----------	85 85 80 75	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
Sn------------------- Sloan	2w	Slight	Severe	Severe	Severe	Pin oak------------- Swamp white oak----- Red maple-----------	85 --- ---	

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Important trees	Site index	
So Starks	2o	Slight	Slight	Slight	Slight	White oak Northern red oak Yellow-poplar Black walnut	80 80 90 ---	Black walnut, American sycamore, yellow-poplar, white oak, green ash, sugar maple.
Sp Stonelick	2o	Slight	Slight	Slight	Slight	Northern red oak	80	Eastern white pine, black walnut, yellow-poplar.
WeA Wea	---	---	---	---	---	---	---	Eastern white pine, red pine, black walnut, black locust, yellow-poplar, white ash.
Wt Westland	2w	Slight	Severe	Severe	Severe	Pin oak Sweetgum White oak	85 90 75	Eastern white pine, baldcypress, Norway spruce, red maple, white ash, sweetgum.
Wx Whitaker	3o	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Sweetgum Northern red oak	75 85 85 80 75	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
XeB Xenia	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, black locust, yellow-poplar, white ash.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; the symbol > means greater than. Absence of an entry means soil does not normally grow trees of this height class]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
AlB2, AlC2-------- Alford	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce------	Eastern white pine, honeylocust.
Ar---------------- Armiesburg	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce------	Eastern white pine, honeylocust.
DaB--------------- Dana	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce------	Eastern white pine, honeylocust.
Dm*. Dumps					
Ee---------------- Eel	---	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, winged euonymus, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce------	Eastern white pine, honeylocust.
EoA, EoB---------- Elston	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, American cranberrybush, autumn-olive.	Eastern hemlock---	---	Eastern white pine, Norway spruce, honeylocust.
FcA--------------- Fincastle	---	Blackhaw, arrowwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
FgA: Flanagan	Mockorange	European burningbush, late lilac, shadblow serviceberry, autumn-olive, Amur honeysuckle, blackhaw, American cranberrybush.	Eastern hemlock	---	Eastern white pine, Norway spruce, honeylocust.
FoB2, FoC2, FsA, FxC3: Fox	---	Autumn-olive, Amur honeysuckle, blackhaw, shadblow service-berry, American cranberrybush, corneliancherry dogwood.	---	Norway spruce, white spruce, American basswood.	Eastern white pine.
Ge: Genesee	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.
GpG. Gosport					
HeF: Hennepin	---	European burningbush, blackhaw, late lilac, Amur honeysuckle, autumn-olive.	Eastern hemlock	Norway spruce	Honeylocust, eastern white pine.
HgB: High Gap	American hazel, flowering quince.	Blackhaw, cutleaf staghorn sumac, forsythia, autumn-olive.	Jack pine, Austrian pine, Russian-olive.	Virginia pine, red pine, scarlet oak.	---
IpA: Ipava	Mockorange	European burningbush, late lilac, shadblow serviceberry, Amur honeysuckle, blackhaw, American cranberrybush, autumn-olive.	Eastern hemlock	---	Eastern white pine, Norway spruce, honeylocust.
McA, McB2: Martinsville	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
MeD2, MsC3, MsD3-- Miami	---	Blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, winged euonymus, American, cranberrybush, autumn-olive.	Eastern hemlock, European burningbush.	Norway spruce	Eastern white pine, honeylocust.
OcA, OcB Ockley	---	Autumn-olive, American cran-berrybush, late lilac, Tatarian honeysuckle.	White spruce	Eastern white pine, Norway spruce.	Carolina poplar.
OrB, OrG*. Orthents					
Pa Palms	Gray dogwood, dwarf purple willow.	Northern white-cedar, Amur honeysuckle, silky dogwood.	Tall purple willow, medium purple willow, redosier dogwood.	---	Lombardy poplar.
Pg*. Pits					
PlA Plano	Gray dogwood	Autumn-olive, Amur honeysuckle.	---	Eastern white pine, red pine, Norway spruce, Douglas-fir.	---
PrC Princeton	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.
PtA, PtB Proctor	Russian-olive	Autumn-olive, silky dogwood, Amur honeysuckle.	---	Norway spruce, red pine.	Eastern white pine.
Ra Ragsdale	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
RbA Raub	Cutleaf staghorn sumac.	Blackhaw, arrowwood, corneliancherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
ReA Reesville	Cutleaf staghorn sumac.	Blackhaw, arrowwood, corneliancherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
RoF: Rodman	American hazel, European privet.	Autumn-olive, forsythia, late lilac, tamarisk.	---	Red pine, eastern white pine, jack pine, Austrian pine.	---
RtA, RtB2: Rush	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce, honeylocust.	Eastern white pine.
RuB2, RuC2: Russell	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.
Sa, Sb: Sable	Gray dogwood, dwarf purple willow.	Silky dogwood, Amur honeysuckle, redosier dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
SeA: Shadeland	tleaf staghorn sumac.	Blackhaw, arrowwood, corneliancherry dogwood, rose-of sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
SgA, SgB: Shipshe	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.
Sh: Shoals	Gray dogwood, dwarf purple willow.	Redosier dogwood, silky dogwood, Amur honeysuckle.	Northern white-cedar, medium purple willow, tall purple willow.	---	Lombardy poplar.
Sm: Sleeth	Cutleaf staghorn sumac.	Blackhaw, arrowwood, corneliancherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	White spruce	American basswood, Norway spruce.	Eastern white pine.
Sn: Sloan	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
So: Starks	Gray dogwood, mockorange.	Silky dogwood, Amur honeysuckle, late lilac, American cranberrybush.	Russian-olive	Norway spruce, red pine, eastern hemlock.	Eastern white pine, Douglas-fir.
Sp: Stonelick	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Honeylocust, eastern white pine.
TaB: Tama	Redosier dogwood, gray dogwood.	Siberian dogwood, bloodtwig dogwood, Tatarian honeysuckle.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
WeA: Wea	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Honeylocust, eastern white pine.
Wt: Westland	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
Wx: Whitaker	---	Autumn-olive, Amur honeysuckle, American cranberrybush, blackhaw, shadblow serviceberry, arrowwood, corneliancherry dogwood, rose-of-sharon.	---	Norway spruce, white spruce, American basswood.	Eastern white pine.
XeB: Xenia	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.

* See map unit description for the composition and behavior of the map unit.

TABLE 7.--BUILDING SITE DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AlB2---------------- Alford	Slight------------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
AlC2---------------- Alford	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: frost action, low strength.
Ar------------------ Armiesburg	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action, low strength.
DaB----------------- Dana	Moderate: wetness, too clayey.	Moderate: shrink-swell, low strength.	Moderate: wetness, shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
Dm*. Dumps					
Ee------------------ Eel	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
EoA----------------- Elston	Severe: cutbanks cave.	Slight------------	Slight------------	Slight------------	Slight.
EoB----------------- Elston	Severe: cutbanks cave.	Slight------------	Slight------------	Moderate: slope.	Slight.
FcA----------------- Fincastle	Severe: wetness.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: frost action, low strength, wetness.
FgA----------------- Flanagan	Severe: wetness.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: frost action, shrink-swell, low strength.
FoB2---------------- Fox	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
FoC2---------------- Fox	Severe: cutbanks cave.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.
FsA----------------- Fox	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
FxC3---------------- Fox	Severe: cutbanks cave.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ge----------------- Genesee	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
GpG---------------- Gosport	Severe: slope, too clayey.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.
HeF---------------- Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
HgB---------------- High Gap	Severe: depth to rock.	Moderate: shrink-swell, low strength.	Severe: depth to rock.	Moderate: shrink-swell, low strength, slope.	Severe: low strength.
IpA---------------- Ipava	Severe: wetness, too clayey.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: frost action, wetness, low strength.
McA---------------- Martinsville	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: frost action, shrink-swell, low strength.
McB2--------------- Martinsville	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Moderate: frost action, shrink-swell, low strength.
MeD2--------------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
MsC3--------------- Miami	Moderate: slope, too clayey.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.
MsD3--------------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
OcA---------------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
OcB---------------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: low strength.
OrB, OrG*. Orthents					
Pa----------------- Palms	Severe: wetness, excess humus, floods.	Severe: wetness, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.
Pg*. Pits					
PlA---------------- Plano	Slight-----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
PrC----------------- Princeton	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, low strength, slope.
PtA----------------- Proctor	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, wetness.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
PtB----------------- Proctor	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, wetness.	Moderate: shrink-swell, slope, low strength.	Severe: frost action, low strength.
Ra------------------ Ragsdale	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.
RbA----------------- Raub	Severe: wetness.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: frost action, low strength.
ReA----------------- Reesville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.
RoF----------------- Rodman	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RtA----------------- Rush	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.	Severe: frost action, low strength.
RtB2---------------- Rush	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
RuB2---------------- Russell	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: frost action, low strength.
RuC2---------------- Russell	Moderate: slope, too clayey.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.
Sa, Sb-------------- Sable	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.
SeA----------------- Shadeland	Severe: depth to rock, wetness.	Severe: wetness.	Severe: depth to rock, wetness.	Severe: wetness.	Severe: frost action, low strength.
SgA----------------- Shipshe	Severe: cutbanks cave.	Slight------------	Slight------------	Slight------------	Moderate: frost action.
SgB----------------- Shipshe	Severe: cutbanks cave.	Slight------------	Slight------------	Moderate: slope.	Moderate: frost action.
Sh------------------ Shoals	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Sm: Sleeth	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.
Sn: Sloan	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.
So: Starks	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength, wetness.
Sp: Stonelick	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
TaB: Tama	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
WeA: Wea	Slight	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.	Severe: low strength.
Wt: Westland	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: low strength, wetness, floods.
Wx: Whitaker	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.
XeB: Xenia	Severe: wetness.	Moderate: shrink-swell, low strength.	Moderate: wetness, shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.

* See map unit description for the composition and behavior of the map unit.

TABLE 8.--SANITARY FACILITIES

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AlB2------------------ Alford	Slight------------	Moderate: seepage, slope.	Slight------------	Slight------------	Good.
AlC2------------------ Alford	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.	Fair: slope.
Ar-------------------- Armiesburg	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
DaB------------------- Dana	Severe: wetness.	Severe: wetness.	Moderate: too clayey, wetness.	Slight------------	Fair: too clayey.
Dm*. Dumps					
Ee-------------------- Eel	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Good.
EoA, EoB-------------- Elston	Slight------------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
FcA------------------- Fincastle	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
FgA------------------- Flanagan	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
FoB2------------------ Fox	Slight------------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
FoC2------------------ Fox	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
FsA------------------- Fox	Slight------------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
FxC3------------------ Fox	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Ge-------------------- Genesee	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
GpG------------------- Gosport	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, slope, depth to rock.	Severe: slope.	Poor: too clayey, slope, area reclaim.
HeF------------------- Hennepin	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope, area reclaim.
HgB------------------- High Gap	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight------------	Poor: area reclaim.
IpA------------------- Ipava	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
McA, McB2----------- Martinsville	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
MeD2---------------- Miami	Severe: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
MsC3---------------- Miami	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
MsD3---------------- Miami	Severe: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
OcA, OcB------------ Ockley	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Fair: too clayey.
OrB, OrG*. Orthents					
Pa------------------ Palms	Severe: wetness, floods, subsides.	Severe: wetness, excess humus, seepage.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, seepage.	Poor: excess humus, wetness.
Pg*. Pits					
PlA----------------- Plano	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Fair: too clayey.
PrC----------------- Princeton	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
PtA, PtB------------ Proctor	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey.
Ra------------------ Ragsdale	Severe: wetness, percs slowly, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
RbA----------------- Raub	Severe: percs slowly, wetness.	Slight-----------	Severe: wetness.	Severe: wetness.	Fair: too clayey.
ReA----------------- Reesville	Severe: percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
RoF----------------- Rodman	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: too sandy, slope, small stones.
RtA, RtB2----------- Rush	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Fair: too clayey, small stones.
RuB2---------------- Russell	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
RuC2---------------- Russell	Moderate: percs slowly, slope.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Sa------------------ Sable	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Sb------------------ Sable	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
SeA----------------- Shadeland	Severe: wetness, depth to rock, percs slowly.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: wetness.	Poor: area reclaim.
SgA, SgB------------ Shipshe	Slight------------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Sh------------------ Shoals	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Sm------------------ Sleeth	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: too clayey.
Sn------------------ Sloan	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
So------------------ Starks	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Good.
Sp------------------ Stonelick	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too sandy.
TaB----------------- Tama	Slight------------	Moderate: slope, seepage.	Moderate: too clayey.	Slight------------	Fair: too clayey.
WeA----------------- Wea	Slight------------	Severe: seepage.	Severe: seepage.	Slight------------	Fair: too clayey.
Wt------------------ Westland	Severe: wetness, floods, percs slowly.	Severe: seepage, wetness, floods.	Severe: seepage, wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Wx------------------ Whitaker	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness, seepage.	Good.
XeB----------------- Xenia	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.

* See map unit description for the composition and behavior of the map unit.

TABLE 9.--CONSTRUCTION MATERIALS

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AlB2: Alford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
AlC2: Alford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Ar: Armiesburg	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
DaB: Dana	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Dm*. Dumps				
Ee: Eel	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
EoA, EoB: Elston	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
FcA: Fincastle	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
FgA: Flanagan	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
FoB2: Fox	Good	Good	Good	Fair: thin layer.
FoC2: Fox	Good	Good	Good	Fair: thin layer, slope.
FsA: Fox	Good	Good	Good	Fair: thin layer.
FxC3: Fox	Good	Good	Good	Fair: too clayey, slope.
Ge: Genesee	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
GpG: Gosport	Poor: shrink-swell, area reclaim, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim, thin layer, slope.
HeF: Hennepin	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim.
HgB: High Gap	Poor: low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, area reclaim.
IpA: Ipava	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
McA, McB2------------- Martinsville	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
MeD2------------------ Miami	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
MsC3------------------ Miami	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
MsD3------------------ Miami	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
OcA, OcB-------------- Ockley	Poor: low strength.	Good-----------------	Good-----------------	Fair: thin layer.
OrB, OrG*. Orthents				
Pa-------------------- Palms	Poor: wetness, low strength.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.
Pg*. Pits				
PlA------------------- Plano	Poor: low strength.	Unsuited-------------	Unsuited-------------	Fair: thin layer.
PrC------------------- Princeton	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
PtA, PtB-------------- Proctor	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Ra-------------------- Ragsdale	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
RbA------------------- Raub	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
ReA------------------- Reesville	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
RoF------------------- Rodman	Poor: slope.	Good-----------------	Good-----------------	Poor: small stones, slope.
RtA, RtB2------------- Rush	Poor: low strength.	Good-----------------	Good-----------------	Fair: thin layer.
RuB2------------------ Russell	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
RuC2------------------ Russell	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
Sa, Sb---------------- Sable	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SeA Shadeland	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
SgA, SgB Shipshe	Good	Good	Good	Fair: thin layer, small stones.
Sh Shoals	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Sm Sleeth	Poor: low strength.	Good	Good	Fair: thin layer.
Sn Sloan	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
So Starks	Poor: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Sp Stonelick	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Fair: thin layer.
TaB Tama	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
WeA Wea	Poor: low strength.	Good	Good	Fair: thin layer.
Wt Westland	Poor: wetness, low strength.	Good	Good	Poor: wetness.
Wx Whitaker	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
XeB Xenia	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

* See map unit description for the composition and behavior of the map unit.

TABLE 10.--WATER MANAGEMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AlB2 Alford	Seepage	Favorable	No water	Not needed	Complex slope	Erodes easily.
AlC2 Alford	Seepage	Favorable	No water	Not needed	Complex slope	Slope, erodes easily.
Ar Armiesburg	Seepage	Favorable	No water	Not needed	Not needed	Favorable.
DaB Dana	Favorable	Favorable	Deep to water	Not needed	Erodes easily	Erodes easily.
Dm*. Dumps						
Ee Eel	Seepage	Favorable	Deep to water, slow refill.	Not needed	Not needed	Favorable.
EoA Elston	Seepage	Seepage	No water	Not needed	Not needed	Favorable.
EoB Elston	Seepage	Seepage	No water	Not needed	Soil blowing	Favorable.
FcA Fincastle	Favorable	Hard to pack, wetness.	Slow refill	Frost action	Not needed	Wetness, erodes easily, percs slowly.
FgA Flanagan	Seepage	Wetness	Deep to water, slow refill.	Frost action	Not needed	Wetness, erodes easily.
FoB2 Fox	Seepage	Seepage	No water	Not needed	Too sandy, soil blowing.	Favorable.
FoC2 Fox	Seepage	Seepage	No water	Not needed	Too sandy, soil blowing.	Slope.
FsA Fox	Seepage	Seepage	No water	Not needed	Not needed	Favorable.
FxC3 Fox	Seepage	Seepage	No water	Not needed	Too sandy	Slope.
Ge Genesee	Seepage	Piping	No water	Not needed	Not needed	Erodes easily.
GpG Gosport	Slope, depth to rock.	Thin layer, hard to pack.	No water	Not needed	Slope, erodes easily.	Slope.
HeF Hennepin	Slope	Favorable	No water	Not needed	Slope	Slope.
HgB High Gap	Depth to rock	Thin layer	No water	Not needed	Favorable	Erodes easily, depth to rock.
IpA Ipava	Favorable	Wetness, hard to pack.	Slow refill	Frost action	Not needed	Wetness, erodes easily.
McA Martinsville	Seepage	Favorable	No water	Not needed	Not needed	Erodes easily.
McB2 Martinsville	Seepage	Favorable	No water	Not needed	Favorable	Erodes easily.
MeD2 Miami	Seepage	Favorable	No water	Not needed	Slope	Slope, erodes easily.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
MsC3------------- Miami	Seepage---------	Favorable-------	No water--------	Not needed------	Complex slope--	Slope, erodes easily.
MsD3------------- Miami	Seepage---------	Favorable-------	No water--------	Not needed------	Slope-----------	Slope, erodes easily.
OcA-------------- Ockley	Seepage---------	Favorable-------	No water--------	Not needed------	Not needed------	Erodes easily.
OcB-------------- Ockley	Seepage---------	Favorable-------	No water--------	Not needed------	Favorable-------	Erodes easily.
OrB, OrG*. Orthents						
Pa--------------- Palms	Seepage---------	Excess humus, wetness.	Favorable-------	Floods, frost action.	Not needed------	Wetness.
Pg*. Pits						
PlA-------------- Plano	Seepage---------	Shrink-swell, low strength.	No water--------	Not needed------	Favorable-------	Favorable.
PrC-------------- Princeton	Seepage---------	Favorable-------	No water--------	Not needed------	Soil blowing----	Slope.
PtA-------------- Proctor	Seepage---------	Favorable-------	Deep to water, slow refill.	Not needed------	Favorable-------	Erodes easily.
PtB-------------- Proctor	Seepage---------	Favorable-------	Deep to water, slow refill.	Not needed------	Erodes easily, wetness.	Erodes easily.
Ra--------------- Ragsdale	Favorable-------	Wetness---------	Slow refill-----	Percs slowly, frost action.	Not needed------	Wetness.
RbA-------------- Raub	Favorable-------	Piping, wetness.	Slow refill-----	Percs slowly, frost action.	Not needed------	Wetness, erodes easily, percs slowly.
ReA-------------- Reesville	Favorable-------	Piping, unstable fill.	Deep to water---	Favorable-------	Wetness---------	Wetness.
RoF-------------- Rodman	Seepage---------	Seepage---------	No water--------	Not needed------	Slope, too sandy.	Slope, droughty.
RtA-------------- Rush	Seepage---------	Favorable-------	No water--------	Not needed------	Not needed------	Erodes easily.
RtB2------------- Rush	Seepage---------	Favorable-------	No water--------	Not needed------	Erodes easily---	Erodes easily.
RuB2------------- Russell	Seepage---------	Favorable-------	No water--------	Not needed------	Favorable-------	Erodes easily.
RuC2------------- Russell	Seepage---------	Favorable-------	No water--------	Not needed------	Favorable-------	Erodes easily, slope.
Sa, Sb----------- Sable	Seepage---------	Wetness---------	Slow refill-----	Frost action----	Not needed------	Wetness.
SeA-------------- Shadeland	Depth to rock	Thin layer, wetness.	Slow refill-----	Depth to rock, frost action.	Not needed------	Wetness, erodes easily, depth to rock.
SgA-------------- Shipshe	Seepage---------	Seepage---------	No water--------	Not needed------	Not needed------	Droughty.
SgB-------------- Shipshe	Seepage---------	Seepage---------	No water--------	Not needed------	Too sandy-------	Droughty.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Sh: Shoals	Seepage	Piping	Slow refill	Floods	Not needed	Wetness.
Sm: Sleeth	Seepage	Wetness	Deep to water, slow refill.	Frost action	Not needed	Wetness.
Sn: Sloan	Favorable	Piping	Favorable	Wetness, floods, poor outlets.	Not needed	Wetness.
So: Starks	Seepage	Favorable	Slow refill	Frost action	Not needed	Wetness, erodes easily.
Sp: Stonelick	Seepage	Seepage	No water	Not needed	Not needed	Droughty.
TaB: Tama	Seepage	Favorable	No water	Not needed	Erodes easily	Erodes easily.
WeA: Wea	Seepage	Favorable	No water	Not needed	Not needed	Erodes easily.
Wt: Westland	Seepage	Wetness	Slow refill	Percs slowly, floods, frost action.	Not needed	Wetness, percs slowly.
Wx: Whitaker	Seepage	Wetness	Deep to water, slow refill.	Frost action	Not needed	Wetness, erodes easily.
XeB: Xenia	Favorable	Compressible, low strength.	Deep to water, slow refill.	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily.

* See map unit description for the composition and behavior of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
AlB2 Alford	Slight	Slight	Moderate: slope.	Slight.
AlC2 Alford	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Ar Armiesburg	Severe: floods.	Moderate: too clayey, floods.	Severe: floods.	Moderate: too clayey, floods.
DaB Dana	Slight	Slight	Moderate: slope.	Slight.
Dm*. Dumps				
Ee Eel	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
EoA Elston	Slight	Slight	Slight	Slight.
EoB Elston	Slight	Slight	Moderate: slope.	Slight.
FcA Fincastle	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
FgA Flanagan	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
FoB2 Fox	Slight	Slight	Moderate: slope.	Slight.
FoC2 Fox	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
FsA Fox	Slight	Slight	Slight	Slight.
FxC3 Fox	Moderate: too clayey, slope.	Moderate: too clayey, slope.	Severe: slope.	Moderate: too clayey.
Ge Genesee	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
GpG Gosport	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, percs slowly.	Severe: slope.
HeF Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HgB High Gap	Slight	Slight	Moderate: slope, depth to rock.	Slight.
IpA Ipava	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
McA Martinsville	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
McB2: Martinsville	Slight	Slight	Moderate: slope.	Slight.
MeD2: Miami	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
MsC3: Miami	Moderate: too clayey, slope.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
MsD3: Miami	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.
OcA: Ockley	Slight	Slight	Slight	Slight.
OcB: Ockley	Slight	Slight	Moderate: slope.	Slight.
OrB, OrG*. Orthents				
Pa: Palms	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.
Pg*. Pits				
PlA: Plano	Slight	Slight	Slight	Slight.
PrC: Princeton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
PtA: Proctor	Slight	Slight	Slight	Slight.
PtB: Proctor	Slight	Slight	Moderate: slope.	Slight.
Ra: Ragsdale	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
RbA: Raub	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
ReA: Reesville	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, percs slowly.	Moderate: wetness.
RoF: Rodman	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
RtA: Rush	Slight	Slight	Slight	Slight.
RtB2: Rush	Slight	Slight	Moderate: slope.	Slight.
RuB2: Russell	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
RuC2: Russell	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Sa, Sb: Sable	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.
SeA: Shadeland	Severe: wetness.	Moderate: wetness.	Moderate: small stones, wetness, depth to rock.	Moderate: wetness.
SgA: Shipshe	Slight	Slight	Slight	Slight.
SgB: Shipshe	Slight	Slight	Moderate: slope.	Slight.
Sh: Shoals	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: wetness, floods.	Moderate: wetness, floods.
Sm: Sleeth	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Sn: Sloan	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
So: Starks	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Sp: Stonelick	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
TaB: Tama	Slight	Slight	Moderate: slope.	Slight.
WeA: Wea	Slight	Slight	Slight	Slight.
Wt: Westland	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
Wx: Whitaker	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
XeB: Xenia	Moderate: percs slowly, wetness.	Slight	Moderate: percs slowly, slope, wetness.	Slight.

* See map unit description for the composition and behavior of the map unit.

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AlB2----------------- Alford	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AlC2----------------- Alford	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ar------------------- Armiesburg	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
DaB------------------ Dana	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Dm*. Dumps										
Ee------------------- Eel	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
EoA, EoB------------- Elston	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
FcA------------------ Fincastle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
FgA------------------ Flanagan	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
FoB2----------------- Fox	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FoC2----------------- Fox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
FsA------------------ Fox	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FxC3----------------- Fox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ge------------------- Genesee	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
GpG------------------ Gosport	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
HeF------------------ Hennepin	Very poor.	Poor	Good	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
HgB------------------ High Gap	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
IpA------------------ Ipava	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
McA, McB2------------ Martinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MeD2----------------- Miami	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MsC3----------------- Miami	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
MsD3 Miami	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
OcA, OcB Ockley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OrB, OrG*. Orthents										
Pa Palms	Good	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
Pg*. Pits										
PlA Plano	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PrC Princeton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PtA, PtB Proctor	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ra Ragsdale	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
RbA Raub	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
ReA Reesville	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
RoF Rodman	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
RtA, RtB2 Rush	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RuB2 Russell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RuC2 Russell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Sa, Sb Sable	Fair	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
SeA Shadeland	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
SgA, SgB Shipshe	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Sh Shoals	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
Sm Sleeth	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Sn Sloan	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
So Starks	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Sp Stonelick	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
TaB----------------- Tama	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WeA----------------- Wea	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Wt------------------ Westland	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wx------------------ Whitaker	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
XeB----------------- Xenia	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

* See map unit description for the composition and behavior of the map unit.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

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

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AlB2, AlC2---------- Alford	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	12-32	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	32-72	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
Ar------------------ Armiesburg	0-15	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
	15-62	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
DaB----------------- Dana	0-12	Silt loam--------	CL	A-6, A-4	0	100	100	95-100	85-95	30-35	8-12
	12-36	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-98	38-54	20-32
	36-48	Clay loam--------	CL	A-6, A-7	0	90-100	90-95	80-90	65-75	37-50	17-30
	48-72	Loam-------------	CL, ML, CL-ML	A-4, A-6	0-3	85-95	80-90	75-85	50-65	17-30	2-14
Dm*. Dumps											
Ee------------------ Eel	0-4	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	75-85	26-40	3-15
	4-21	Silt loam, loam	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	26-40	3-15
	21-60	Stratified sandy loam to silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	70-80	55-70	26-40	3-15
EoA, EoB------------ Elston	0-15	Sandy loam-------	SM	A-2, A-4	0	100	100	60-70	30-40	<30	NP-6
	15-36	Sandy loam, loam, sandy clay loam.	SM, CL, SC	A-4, A-6	0	95-100	75-95	50-80	35-65	<30	NP-15
	36-72	Loamy sand, sandy loam.	SP-SM, SM, SC, SM-SC	A-2-4, A-3, A-1-b	0-3	95-100	75-95	45-75	5-30	<25	NP-10
	72-80	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-b	0-3	95-100	70-95	40-70	5-25	---	NP
FcA----------------- Fincastle	0-12	Silt loam--------	CL, ML	A-4, A-6	0	100	95-100	90-100	75-93	27-36	4-12
	12-38	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	38-54	20-32
	38-50	Clay loam--------	CH, CL	A-7	0	95-100	90-98	85-95	75-85	45-58	30-38
	50-72	Loam-------------	CL, ML, CL-ML	A-4	0-3	88-96	82-90	70-86	50-66	20-30	3-10
FgA----------------- Flanagan	0-16	Silt loam--------	CL	A-7, A-6	0	100	100	95-100	85-100	35-50	15-30
	16-49	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	49-84	Loam, clay loam, silt loam.	CL, ML, SC	A-4, A-6, A-7	0	85-100	80-100	70-100	36-100	20-45	5-30
FoB2, FoC2---------- Fox	0-11	Sandy loam-------	SM	A-4, A-2	0	95-100	90-100	55-75	30-45	---	NP
	11-34	Clay loam, loam, gravelly clay loam.	CL, SC	A-1, A-2, A-3	0	85-100	75-95	50-95	20-65	25-45	10-25
	34-60	Sand and gravel	SP, SM, GP, GM	A-1, A-2, A-3	0-5	40-100	35-100	15-95	2-15	---	NP
FsA----------------- Fox	0-11	Loam-------------	ML, CL, CL-ML	A-4	0	95-100	85-100	75-95	55-90	20-30	3-10
	11-34	Clay loam, loam, gravelly clay loam.	CL, SC	A-1, A-2, A-3	0	85-100	75-95	50-95	20-65	25-45	10-25
	34-60	Sand and gravel	SP, SM, GP, GM	A-1, A-2, A-3	0-5	40-100	35-100	15-95	2-15	---	NP

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
FxC3----------------- Fox	0-11	Clay loam--------	CL	A-6	0	90-100	75-100	75-95	60-80	20-40	10-20
	11-34	Clay loam, loam, gravelly clay loam.	CL, SC	A-1, A-2, A-3	0	85-100	75-95	50-95	20-65	25-45	10-25
	34-60	Sand and gravel	SP, SM, GP, GM	A-1, A-2, A-3	0-5	40-100	35-100	15-95	2-15	---	NP
Ge------------------ Genesee	0-10	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	75-85	26-40	3-15
	10-32	Silt loam, loam	ML, CL	A-4, A-6	0	100	100	90-100	75-85	26-40	3-15
	32-72	Stratified sandy loam to silt loam.	ML, CL	A-4, A-6	0	90-100	85-100	60-80	50-70	26-40	3-15
GpG----------------- Gosport	0-9	Shaly silt loam	ML, CL	A-4, A-6	0	55-80	55-80	55-80	45-75	25-40	5-15
	9-25	Shaly silty clay loam, shaly silty clay.	CH, CL	A-7-6	0-5	50-80	50-80	50-80	50-75	40-60	20-35
	25-40	Weathered bedrock.									
HeF----------------- Hennepin	0-5	Loam-------------	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	70-100	60-95	25-40	5-20
	5-13	Loam, sandy loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
	13-60	Loam, sandy loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
HgB----------------- High Gap	0-8	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	8-38	Clay loam, silty clay loam, channery clay loam.	CL, SC	A-6, A-7	0	50-80	50-80	50-80	40-75	30-45	15-25
	38	Unweathered bedrock.									
IpA----------------- Ipava	0-18	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	30-40	6-16
	18-43	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	95-100	90-100	51-68	26-39
	43-72	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	30-40	11-19
McA, McB2----------- Martinsville	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-90	22-33	4-12
	13-60	Clay loam, silty clay loam, sandy clay loam.	CL	A-4, A-6	0	100	90-100	65-90	40-90	20-35	8-17
	60-72	Stratified sand to sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4	0	95-100	85-100	80-95	40-60	<25	4-9
MeD2---------------- Miami	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-90	22-34	6-15
	6-28	Clay loam, silty clay loam, sandy clay loam.	CL	A-6, A-7	0	92-99	89-97	78-95	64-95	35-50	17-31
	28-60	Loam, clay loam, sandy loam.	CL, CL-ML, ML	A-4, A-6	0-3	88-94	83-89	74-87	50-64	17-30	2-14
MsC3, MsD3---------- Miami	0-6	Clay loam--------	CL	A-6, A-7	0	100	90-100	75-95	65-95	30-45	15-25
	6-28	Clay loam, silty clay loam, sandy clay loam.	CL	A-6, A-7	0	92-99	89-97	78-95	64-95	35-50	17-31
	28-60	Loam, clay loam, sandy loam.	CL, ML, CL-ML	A-4, A-6	0-3	88-94	83-89	74-87	50-64	17-30	2-14

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
OcA, OcB----------- Ockley	0-17	Silt loam-------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	3-12
	17-32	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	75-100	65-90	50-90	35-50	15-30
	32-58	Gravelly clay loam, gravelly sandy clay loam.	CL, SC, GC	A-6, A-7	0-2	70-85	45-75	40-70	35-55	30-50	15-30
	58-72	Stratified sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-20	2-10	---	NP
OrB, OrG*. Orthents											
Pa---------------- Palms	0-40	Muck------------	Pt	---	---	---	---	---	---	---	---
	40-72	Clay loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
Pg*. Pits											
PlA--------------- Plano	0-14	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	20-30	5-15
	14-42	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	95-100	25-40	10-25
	42-70	Stratified silt loam to sandy loam.	ML, SM, CL, SC	A-4, A-2	0-5	90-100	80-90	60-90	30-70	<25	NP-10
PrC--------------- Princeton	0-11	Fine sandy loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0	100	100	70-85	40-60	15-30	5-15
	11-35	Sandy clay loam	SC, CL	A-6	0	100	100	80-90	35-55	25-35	10-15
	35-44	Sandy loam------	SC, SM-SC	A-4, A-6, A-2-4, A-2-6	0	100	100	60-70	30-40	15-25	5-15
	44-68	Stratified fine sand to silt.	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	100	65-90	20-55	<20	NP-5
PtA, PtB---------- Proctor	0-18	Silt loam-------	CL	A-6	0	100	100	95-100	85-100	25-40	10-22
	18-34	Silty clay loam, clay loam.	CL	A-7, A-6	0	95-100	90-100	85-100	65-90	25-50	10-25
	34-72	Stratified silt loam to sand.	SC, CL, SM-SC, CL-ML	A-2, A-4, A-6	0	85-100	80-100	50-100	25-80	20-40	5-20
Ra---------------- Ragsdale	0-13	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	13-46	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	46-80	Silt loam, loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
RbA--------------- Raub	0-13	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-95	25-35	5-15
	13-37	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	80-95	35-55	20-35
	37-54	Clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	90-100	85-95	60-85	35-50	15-25
	54-72	Loam, clay loam	CL, ML, SC, SM	A-4, A-6	0-5	85-95	80-90	70-85	40-65	15-30	NP-15
ReA--------------- Reesville	0-12	Silt loam-------	ML, CL-ML	A-4	0	100	90-100	90-100	85-100	24-36	4-10
	12-38	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	100	90-100	90-100	90-100	22-50	4-28
	38-66	Loam, silt loam	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	80-90	70-90	20-40	3-18

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RoF----------------- Rodman	0-11	Gravelly loam----	ML, CL, SM, GM	A-4	0-2	70-85	65-85	60-80	36-65	<30	3-9
	11-60	Stratified sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	22-55	7-20	2-10	---	NP
RtA, RtB2----------- Rush	0-11	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	80-95	29-38	7-15
	11-34	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	44-52	21-26
	34-65	Clay loam, sandy clay loam, gravelly clay loam.	CL, SC	A-6, A-7, A-2	1-5	75-90	60-85	50-80	30-60	30-45	15-22
	65-72	Stratified sand to gravelly sand.	SP, SP-SM, GP-GM, GP	A-1	1-5	30-70	22-55	7-20	2-10	<30	NP
RuB2, RuC2---------- Russell	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-90	20-35	5-15
	7-30	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
	30-55	Clay loam, loam	CL	A-6, A-7	0	90-100	90-95	80-90	65-75	35-50	17-31
	55-72	Loam, clay loam	CL, ML, CL-ML	A-4, A-6	0-3	85-95	80-90	75-85	50-65	<30	2-14
Sa------------------ Sable	0-19	Silty clay loam	CL, OH, CH	A-7	0	100	100	98-100	95-100	41-65	15-35
	19-54	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	98-100	95-100	41-55	20-35
	54-62	Silt loam--------	CL	A-6, A-4	0	100	100	98-100	95-100	30-40	10-30
	62-72	Stratified fine sand to coarse sand.	SP-SM, SM	A-1, A-3	0	90-100	85-100	45-80	5-30	---	NP
Sb------------------ Sable	0-15	Silty clay loam	CL	A-6, A-7	0	100	95-100	85-100	72-95	30-50	20-30
	15-54	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	100	95-100	85-100	45-80	30-50	20-30
	54-72	Loam, silt loam, clay loam.	CL	A-6, A-7	0-5	95-100	90-100	75-95	45-80	30-50	15-30
SeA----------------- Shadeland	0-11	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	90-100	70-100	60-100	50-90	25-35	5-15
	11-30	Silty clay loam, clay loam, sandy clay loam.	CL	A-6, A-7	0-5	90-100	70-100	65-100	55-95	35-50	20-30
	30-35	Very shaly clay loam.	CL	A-6, A-7	0-5	30-50	25-50	20-50	15-40	35-45	15-25
	35	Unweathered bedrock.									
SgA, SgB------------ Shipshe	0-14	Loam-------------	CL, CL-ML, SC, SM-SC	A-4, A-6	0-2	90-100	75-100	65-95	45-90	20-30	5-15
	14-38	Very gravelly loam, very gravelly clay loam, gravelly clay loam.	GC, GM-GC, GP-GC	A-2, A-1, A-4, A-6	0-2	30-60	25-50	25-50	15-40	<25	5-12
	38-60	Stratified sandy loam to very gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-20	2-10	---	NP

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Sh------------------- Shoals	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	22-36	6-15
	8-60	Silt loam, loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	25-40	4-15
	60-72	Stratified silt loam to sandy loam.	ML	A-4	0-3	90-100	85-100	60-80	50-70	32-40	3-8
Sm------------------- Sleeth	0-11	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	90-100	75-95	50-85	26-30	3-12
	11-34	Clay loam, silty clay loam.	CL	A-6	0	85-95	85-95	80-90	65-75	30-40	15-25
	34-48	Gravelly clay loam, gravelly sandy clay loam, gravelly loam.	CL	A-6	0-3	65-95	60-85	55-70	50-70	30-40	15-25
	48-60	Stratified sand to gravelly sand.	SP, GP, SP-SM, GP-GM	A-1	1-5	30-70	22-55	7-20	2-10	---	NP
Sn------------------- Sloan	0-15	Loam-------------	CL, ML	A-6, A-4, A-7	0	100	95-100	85-100	70-95	30-45	8-15
	15-45	Loam, clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	80-95	50-90	30-45	8-18
	45-60	Stratified loam to sandy loam.	ML, CL, SM, SC	A-4, A-6	0	95-100	90-100	60-95	40-80	25-40	3-15
So------------------- Starks	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	22-35	5-15
	12-38	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	35-45	15-24
	38-62	Sandy clay loam, loam, silty clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	95-100	90-100	80-95	40-80	20-40	6-17
	62-72	Stratified loamy sand to silt loam.	SM, SC, ML, CL	A-2, A-4, A-6	0-5	90-100	80-95	40-90	30-60	<30	NP-15
Sp------------------- Stonelick	0-10	Sandy loam-------	SM, SC, ML, CL	A-4, A-2	0	85-100	70-100	50-70	30-60	20-32	NP-10
	10-72	Stratified loam to loamy sand.	SM, SP-SM	A-2, A-4, A-3, A-1-b	0	85-100	70-95	40-60	5-40	---	NP
TaB------------------ Tama	0-15	Silt loam--------	ML, CL, OL	A-6, A-7	0	100	100	100	95-100	35-50	10-20
	15-55	Silt loam, silty clay loam.	CL	A-7	0	100	100	100	95-100	40-50	15-25
	55-72	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
WeA------------------ Wea	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	16-28	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	95-100	90-95	85-95	65-90	35-50	15-30
	28-59	Gravelly clay loam, very gravelly clay loam.	CL, SM-SC, SC, GC	A-4, A-6	0-5	40-80	35-80	30-80	25-65	15-30	5-15
	59-72	Stratified sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-20	0-10	---	NP

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Wt------------------ Westland	0-14	Silty clay loam	CL, ML	A-6, A-7	0	100	95-100	90-100	75-90	30-45	10-25
	14-18	Clay loam--------	CL	A-6, A-7	0	95-100	90-100	80-90	65-75	35-50	15-30
	18-44	Gravelly clay loam, gravelly sandy loam.	CL	A-6	0-5	65-75	60-70	55-70	50-70	30-50	15-30
	44-60	Stratified sand to gravelly sand.	SP, GP, SP-SM, GP-GM	A-1	1-5	30-70	22-55	7-20	2-10	---	NP
Wx------------------ Whitaker	0-11	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	4-12
	11-35	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-80	30-47	12-26
	35-72	Stratified coarse sand to clay.	CL, SC, ML, SM	A-4	0	98-100	98-100	60-85	40-60	15-25	3-9
Xeb----------------- Xenia	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	12-28	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	28-52	Clay loam--------	CL	A-6, A-7	0-5	92-100	90-95	75-95	65-75	35-50	15-30
	52-72	Loam------------	CL, ML, SC, SM	A-4, A-6	0-5	85-95	80-90	75-90	40-65	15-30	NP-15

* See map unit description for the composition and behavior of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
AlB2, AlC2	0-12	0.6-2.0	0.22-0.24	5.1-7.3	Low	Moderate	Moderate	0.37	5	5
Alford	12-32	0.6-2.0	0.18-0.20	4.5-6.5	Moderate	Moderate	Moderate	0.37		
	32-72	0.6-2.0	0.20-0.22	4.5-7.3	Low	Moderate	Moderate	0.37		
Ar	0-15	0.6-2.0	0.21-0.23	6.1-7.3	Moderate	Moderate	Low	0.28	5	6
Armiesburg	15-62	0.6-2.0	0.18-0.20	6.1-7.3	Moderate	Moderate	Low	0.28		
DaB	0-12	0.6-2.0	0.22-0.24	5.6-7.3	Low	Low	Moderate	0.32	5	5
Dana	12-36	0.6-2.0	0.18-0.20	5.1-6.0	Moderate	Moderate	Moderate	0.43		
	36-48	0.6-2.0	0.15-0.19	6.1-7.3	Moderate	Low	Low	0.43		
	48-72	0.2-0.6	0.05-0.19	6.6-8.4	Low	Low	Low	0.43		
Dm*. Dumps										
Ee	0-4	0.6-2.0	0.20-0.24	6.1-7.8	Low	Moderate	Low	0.37	5	5
Eel	4-21	0.6-2.0	0.17-0.22	6.1-8.4	Low	Moderate	Low	0.37		
	21-60	0.6-2.0	0.19-0.21	7.4-8.4	Low	Moderate	Low	0.37		
EoA, EoB	0-15	2.0-6.0	0.12-0.15	5.6-6.0	Low	Low	Moderate	0.20	4	3
Elston	15-36	2.0-6.0	0.12-0.18	4.5-6.0	Low	Low	Moderate	0.20		
	36-72	2.0-6.0	0.08-0.13	5.6-6.0	Low	Low	Moderate	0.20		
	72-80	>20	0.05-0.07	7.4-8.4	Low	Low	Low	0.15		
FcA	0-12	0.6-2.0	0.22-0.24	5.1-6.5	Low	High	Moderate	0.37	5	5
Fincastle	12-38	0.2-0.6	0.18-0.20	5.1-6.0	Moderate	High	Moderate	0.37		
	38-50	0.2-0.6	0.15-0.19	5.1-7.3	Moderate	High	Moderate	0.37		
	50-72	0.2-0.6	0.05-0.19	7.4-8.4	Low	High	Low	0.37		
FgA	0-16	0.6-2.0	0.22-0.24	5.6-7.3	Moderate	High	Moderate	0.28	5	6
Flanagan	16-49	0.6-2.0	0.15-0.22	5.6-7.3	High	High	Moderate	0.43		
	49-84	0.6-2.0	0.15-0.22	6.1-8.4	Low	High	Low	0.43		
FoB2, FoC2	0-11	0.6-2.0	0.13-0.15	5.1-6.5	Low	Low	Moderate	0.24	3	3
Fox	11-34	0.6-2.0	0.12-0.14	6.1-7.8	Moderate	Low	Moderate	0.37		
	34-60	>6.0	0.02-0.04	7.9-8.4	Low	Low	Low	0.10		
FsA	0-11	0.6-2.0	0.20-0.22	5.1-6.5	Low	Low	Moderate	0.37	3	6
Fox	11-34	0.6-2.0	0.12-0.14	6.1-7.8	Moderate	Low	Moderate	0.37		
	34-60	>6.0	0.02-0.04	7.9-8.4	Low	Low	Low	0.10		
FxC3	0-11	0.6-2.0	0.17-0.19	5.1-6.5	Moderate	Low	Moderate	0.32	2	6
Fox	11-34	0.6-2.0	0.12-0.14	6.1-7.8	Moderate	Low	Moderate	0.37		
	34-60	>6.0	0.02-0.04	7.9-8.4	Low	Low	Low	0.10		
Ge	0-10	0.6-2.0	0.20-0.24	6.1-7.8	Low	Low	Low	0.37	5	5
Genesee	10-32	0.6-2.0	0.17-0.22	6.1-8.4	Low	Low	Low	0.37		
	32-72	0.6-2.0	0.19-0.21	7.4-8.4	Low	Low	Low	0.37		
GpG	0-9	0.2-0.6	0.18-0.20	5.1-6.5	High	High	Low	0.43	3	6
Gosport	9-25	<0.06	0.12-0.14	3.6-5.0	High	High	High	0.32		
	25-40	---	---	---	---	---	---	---		
HeF	0-5	0.6-2.0	0.18-0.24	6.1-7.8	Low	Low	Low	0.32	4	5
Hennepin	5-13	0.2-2.0	0.14-0.22	6.1-7.8	Low	Low	Low	0.32		
	13-60	0.2-0.6	0.07-0.11	6.1-8.4	Low	Low	Low	0.32		
HgB	0-8	0.6-2.0	0.22-0.24	4.5-6.0	Low	Low	High	0.37	4	5
High Gap	8-38	0.6-2.0	0.15-0.19	4.5-6.0	Low	Moderate	High	0.37		
	38	---	---	---	---	---	---	---		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
IpA----------------- Ipava	0-18	0.6-2.0	0.22-0.24	5.6-7.3	Moderate	High------	Moderate	0.28	5	6
	18-43	0.2-0.6	0.11-0.20	5.6-7.3	High-------	High------	Moderate	0.43		
	43-72	0.2-0.6	0.20-0.22	6.1-7.8	Moderate	High------	Low-------	0.43		
McA, McB2----------- Martinsville	0-13	0.6-2.0	0.20-0.24	5.6-7.3	Low--------	Moderate	Moderate	0.37	4	5
	13-60	0.6-2.0	0.17-0.20	5.1-6.0	Moderate	Moderate	Moderate	0.37		
	60-72	2.0-6.0	0.19-0.21	7.4-8.4	Low--------	Low-------	Low-------	0.24		
MeD2---------------- Miami	0-6	0.6-2.0	0.20-0.24	5.6-7.3	Low--------	Low-------	Moderate	0.37	5	5
	6-28	0.6-2.0	0.15-0.20	5.6-6.0	Moderate	Moderate	Moderate	0.37		
	28-60	0.2-2.0	0.05-0.19	6.6-8.4	Low--------	Low-------	Low-------	0.37		
MsC3, MsD3---------- Miami	0-6	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	Moderate	Moderate	0.37	4	6
	6-28	0.6-2.0	0.15-0.20	5.6-6.0	Moderate	Moderate	Moderate	0.37		
	28-60	0.2-2.0	0.05-0.19	6.6-8.4	Low--------	Low-------	Low-------	0.37		
OcA, OcB------------ Ockley	0-17	0.6-2.0	0.20-0.24	5.6-6.5	Low--------	Low-------	Moderate	0.37	5	5
	17-32	0.6-2.0	0.15-0.20	4.5-6.0	Moderate	Moderate	Moderate	0.37		
	32-58	0.6-2.0	0.12-0.14	5.6-6.5	Moderate	Moderate	Moderate	0.24		
	58-72	>20	0.02-0.04	7.4-8.4	Low--------	Low-------	Low-------	0.10		
OrB, OrG*. Orthents										
Pa------------------ Palms	0-40	2.0-6.0	0.35-0.45	5.1-8.4	-----------	High------	Moderate	0.10	5	3
	40-72	0.6-2.0	0.14-0.22	6.1-8.4	Low--------	High------	Low-------	0.10		
Pg*. Pits										
PlA----------------- Plano	0-14	0.6-2.0	0.22-0.24	6.1-7.3	Low--------	Low-------	Low-------	0.32	5	6
	14-42	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	Moderate	Low-------	0.43		
	42-70	0.6-2.0	0.11-0.22	6.6-8.4	Low--------	Low-------	Low-------	0.43		
PrC----------------- Princeton	0-11	0.6-2.0	0.18-0.20	5.6-7.3	Low--------	Low-------	Moderate	0.24	5	3
	11-35	0.6-2.0	0.16-0.18	5.1-6.5	Low--------	Moderate	Moderate	0.32		
	35-44	2.0-6.0	0.12-0.14	5.1-6.5	Low--------	Low-------	Moderate	0.32		
	44-68	2.0-6.0	0.06-0.08	6.6-8.4	Low--------	Low-------	Low-------	0.17		
PtA, PtB------------ Proctor	0-18	0.6-2.0	0.22-0.24	5.6-7.3	Low--------	Moderate	Moderate	0.32	5	6
	18-34	0.6-2.0	0.15-0.20	5.6-6.5	Moderate	Moderate	Moderate	0.43		
	34-72	0.6-6.0	0.07-0.19	6.1-7.3	Low--------	Low-------	Low-------	0.43		
Ra------------------ Ragsdale	0-13	0.6-2.0	0.22-0.24	6.1-7.3	Low--------	High------	Low-------	0.28	5	5
	13-46	0.06-0.2	0.18-0.20	6.1-7.3	Moderate	High------	Low-------	0.28		
	46-80	0.06-0.2	0.20-0.22	6.6-8.4	Low--------	High------	Low-------	0.28		
RbA----------------- Raub	0-13	0.6-2.0	0.22-0.24	5.6-7.3	Low--------	High------	Moderate	0.37	3	5
	13-37	0.06-0.2	0.18-0.20	5.1-6.5	Moderate	High------	Moderate	0.37		
	37-54	0.06-0.2	0.15-0.19	6.1-7.3	Moderate	High------	Low-------	0.37		
	54-72	0.06-0.6	0.05-0.19	7.4-8.4	Low--------	High------	Low-------	0.37		
ReA----------------- Reesville	0-12	0.6-2.0	0.17-0.24	6.1-6.5	Low--------	High------	Low-------	0.37	5	6
	12-38	0.2-2.0	0.15-0.19	6.1-7.3	Moderate	High------	Low-------	0.37		
	38-66	0.2-2.0	0.15-0.18	7.4-8.4	Low--------	High------	Low-------	0.37		
RoF----------------- Rodman	0-11	2.0-6.0	0.10-0.12	6.6-7.8	Low--------	Low-------	Low-------	0.20	3	8
	11-60	>20	0.02-0.04	7.4-8.4	Low--------	Low-------	Low-------	0.10		
RtA, RtB2----------- Rush	0-11	0.6-2.0	0.22-0.24	5.1-6.0	Low--------	Low-------	Moderate	0.37	5	5
	11-34	0.6-2.0	0.18-0.20	5.6-6.0	Moderate	Moderate	Moderate	0.37		
	34-65	0.6-2.0	0.15-0.19	5.6-7.3	Moderate	Moderate	Moderate	0.37		
	65-72	>20	0.02-0.04	7.4-8.4	Low--------	Low-------	Low-------	0.10		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
RuB2, RuC2---------- Russell	0-7	0.6-2.0	0.21-0.24	5.6-7.3	Low--------	Low-------	Moderate	0.37	5	5
	7-30	0.6-2.0	0.18-0.20	4.5-6.0	Moderate	Moderate	Moderate	0.37		
	30-55	0.6-2.0	0.15-0.19	5.6-7.3	Moderate	Moderate	Moderate	0.37		
	55-72	0.2-2.0	0.05-0.19	7.4-8.4	Low--------	Low-------	Low-------	0.37		
Sa----------------- Sable	0-19	0.6-2.0	0.22-0.24	5.6-7.3	Moderate	High------	Moderate	0.28	5	4
	19-54	0.6-2.0	0.18-0.20	6.1-7.8	Moderate	High------	Low-------	0.28		
	54-62	0.2-2.0	0.20-0.22	6.6-7.8	Low--------	High------	Low-------	0.28		
	62-72	>6.0	0.05-0.07	6.6-8.4	Low--------	High------	Low-------	0.15		
Sb----------------- Sable	0-15	0.6-2.0	0.21-0.23	5.6-7.3	Moderate	High------	Moderate	0.28	5	7
	15-54	0.6-2.0	0.21-0.24	5.6-7.3	Moderate	High------	Moderate	0.28		
	54-72	0.6-2.0	0.17-0.20	6.1-7.8	Moderate	High------	Low-------	0.28		
SeA---------------- Shadeland	0-11	0.6-2.0	0.20-0.24	5.1-6.5	Low--------	High------	Moderate	0.37	4	5
	11-30	0.2-0.6	0.18-0.20	5.1-6.0	Moderate	High------	Moderate	0.37		
	30-35	0.2-0.6	0.15-0.19	5.1-6.0	Moderate	High------	Moderate	0.37		
	35	---	---	---	-----------	----------	----------	---		
SgA, SgB----------- Shipshe	0-14	0.6-2.0	0.20-0.24	5.6-7.3	Low--------	Low-------	Moderate	0.28	4	5
	14-38	2.0-6.0	0.05-0.07	5.6-6.5	Low--------	Low-------	Moderate	0.10		
	38-60	>20	0.02-0.04	7.9-8.4	Low--------	Low-------	Low-------	0.10		
Sh----------------- Shoals	0-8	0.6-2.0	0.22-0.24	6.1-7.8	Low--------	High------	Low-------	0.37	5	5
	8-60	0.6-2.0	0.17-0.22	6.1-7.8	Low--------	High------	Low-------	0.37		
	60-72	0.6-2.0	0.12-0.21	6.6-7.3	Low--------	High------	Low-------	0.37		
Sm----------------- Sleeth	0-11	0.6-2.0	0.20-0.24	6.6-7.3	Low--------	High------	Low-------	0.32	5	5
	11-34	0.6-2.0	0.15-0.19	5.6-6.5	Moderate	High------	Low-------	0.32		
	34-48	0.6-2.0	0.14-0.16	6.6-8.4	Moderate	High------	Low-------	0.32		
	48-60	>20	0.02-0.04	7.9-8.4	Low--------	Low-------	Low-------	0.10		
Sn----------------- Sloan	0-15	0.6-2.0	0.20-0.24	6.1-7.8	Moderate	High------	Low-------	0.37	5	6
	15-45	0.6-2.0	0.15-0.19	6.1-8.4	Moderate	High------	Low-------	0.37		
	45-60	0.6-2.0	0.13-0.18	6.6-8.4	Low--------	High------	Low-------	0.37		
So----------------- Starks	0-12	0.6-2.0	0.22-0.24	5.6-6.5	Moderate	High------	Moderate	0.37	5	6
	12-38	0.2-2.0	0.18-0.20	5.1-6.5	Moderate	High------	Moderate	0.37		
	38-62	0.2-2.0	0.16-0.19	5.1-7.3	Moderate	High------	Moderate	0.37		
	62-72	2.0-6.0	0.08-0.18	5.6-7.3	Low--------	Low-------	Moderate	0.37		
Sp----------------- Stonelick	0-10	2.0-6.0	0.09-0.13	6.6-7.8	Low--------	Low-------	Low-------	0.24	5	3
	10-72	2.0-6.0	0.05-0.09	6.6-7.8	Low--------	Low-------	Low-------	0.24		
TaB---------------- Tama	0-15	0.6-2.0	0.22-0.24	5.1-5.5	Moderate	Moderate	Moderate	0.32	5	7
	15-55	0.6-2.0	0.18-0.20	5.1-5.5	Moderate	Moderate	Moderate	0.43		
	55-72	0.6-2.0	0.18-0.20	5.6-6.0	Moderate	Moderate	Moderate	0.43		
WeA---------------- Wea	0-16	0.6-2.0	0.20-0.24	5.1-6.5	Low--------	Low-------	Moderate	0.32	5	5
	16-28	0.6-2.0	0.15-0.20	5.1-6.5	Moderate	Moderate	Moderate	0.43		
	28-59	0.6-2.0	0.10-0.12	6.1-8.4	Low--------	Low-------	Moderate	0.24		
	59-72	>20	0.02-0.04	7.4-8.4	Low--------	Low-------	Low-------	0.10		
Wt----------------- Westland	0-14	0.6-2.0	0.22-0.24	5.6-7.3	Moderate	High------	Low-------	0.28	5	7
	14-18	0.06-0.2	0.15-0.19	5.6-7.3	Moderate	High------	Low-------	0.28		
	18-44	0.06-0.2	0.14-0.16	5.6-7.3	Moderate	High------	Low-------	0.28		
	44-60	>20	0.02-0.04	7.4-8.4	Low--------	High------	Low-------	0.10		
Wx----------------- Whitaker	0-11	0.6-2.0	0.20-0.24	5.6-7.3	Low--------	Moderate	Moderate	0.37	5	5
	11-35	0.6-2.0	0.15-0.19	5.1-6.0	Moderate	High------	Moderate	0.37		
	35-72	0.6-6.0	0.19-0.21	6.6-8.4	Low--------	High------	Low-------	0.37		
XeB---------------- Xenia	0-12	0.6-2.0	0.22-0.24	6.6-7.3	Low--------	Moderate	Low-------	0.37	5	5
	12-28	0.2-0.6	0.18-0.20	5.1-6.0	Moderate	High------	Moderate	0.37		
	28-52	0.2-0.6	0.15-0.19	5.1-7.3	Moderate	High------	Moderate	0.37		
	52-72	0.2-2.0	0.05-0.19	7.9-8.4	Low--------	Moderate	Low-------	0.37		

* See map unit description for the composition and behavior of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
AlB2, AlC2: Alford	B	None	---	---	>6.0	---	---	>60	---	High.
Ar: Armiesburg	B	Frequent	Brief	Oct-Jun	>6.0	---	---	>60	---	High.
DaB: Dana	B	None	---	---	3.0-6.0	Perched	Mar-Apr	>60	---	High.
Dm*. Dumps										
Ee: Eel	C	Rare to common.	Brief	Oct-Jun	3.0-6.0	Apparent	Jan-Apr	>60	---	High.
EoA, EoB: Elston	B	None	---	---	>6.0	---	---	>60	---	Low.
FcA: Fincastle	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High.
FgA: Flanagan	B	None	---	---	1.0-3.0	Apparent	Apr-Jun	>60	---	High.
FoB2, FoC2, FsA, FxC3: Fox	B	None	---	---	>6.0	---	---	>60	---	Moderate.
Ge: Genesee	B	Rare to common.	Brief	Oct-Jun	>6.0	---	---	>60	---	Moderate.
GpG: Gosport	D	None	---	---	>6.0	---	---	20-40	Rippable	Moderate.
HeF: Hennepin	B	None	---	---	>6.0	---	---	>60	---	Moderate.
HgB: High Gap	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate.
IpA: Ipava	B	None	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High.
McA, McB2: Martinsville	B	None	---	---	>6.0	---	---	>60	---	Moderate.
MeD2, MsC3, MsD3: Miami	B	None	---	---	>6.0	---	---	>60	---	Moderate.
OcA, OcB: Ockley	B	None	---	---	>6.0	---	---	>60	---	Moderate.
OrB, OrG*. Orthents										
Pa: Palms	A/D	Frequent	Long	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High.
Pg*. Pits										
PlA: Plano	B	None	---	---	>3.0	Apparent	Feb-Jun	>60	---	High.
PrC: Princeton	B	None	---	---	>6.0	---	---	>60	---	Moderate.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	
					Ft			In		
PtA, PtB----------- Proctor	B	None---------	---	---	2.5-6.0	Apparent	Jan-May	>60	---	High.
Ra----------------- Ragsdale	B/D	Frequent-----	Brief------	Dec-May	0.-1.0	Apparent	Dec-May	>60	---	High.
RbA---------------- Raub	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High.
ReA---------------- Reesville	C	None---------	---	---	1.0-2.0	Apparent	Jan-Apr	>60	---	High.
RoF---------------- Rodman	A	None---------	---	---	>6.0	---	---	>60	---	Low.
RtA, RtB2---------- Rush	B	None---------	---	---	>6.0	---	---	>60	---	High.
RuB2, RuC2--------- Russell	B	None---------	---	---	>6.0	---	---	>60	---	High.
Sa, Sb------------- Sable	B/D	Occasional	Brief------	Mar-Jun	0-2.0	Apparent	Mar-Jun	>60	---	High.
SeA---------------- Shadeland	C	None---------	---	---	1.0-2.0	Perched	Jan-Apr	20-40	Hard	High.
SgA, SgB----------- Shipshe	B	None---------	---	---	>6.0	---	---	>60	---	Moderate.
Sh----------------- Shoals	C	Rare to frequent.	Brief------	Oct-Jun	1.0-3.0	Apparent	Jan-Apr	>60	---	High.
Sm----------------- Sleeth	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High.
Sn----------------- Sloan	B/D	Frequent-----	Very brief	Nov-Jun	0-0.5	Apparent	Nov-Jun	>60	---	High.
So----------------- Starks	C	None---------	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High.
Sp----------------- Stonelick	B	Common-------	Very brief	Nov-Jun	>6.0	---	---	>60	---	Moderate.
TaB---------------- Tama	B	None---------	---	---	>6.0	---	---	>60	---	High.
WeA---------------- Wea	B	None---------	---	---	>6.0	---	---	>60	---	Moderate.
Wt----------------- Westland	B/D	Frequent-----	Brief------	Dec-May	0-1.0	Apparent	Dec-May	>60	---	High.
Wx----------------- Whitaker	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High.
XeB---------------- Xenia	B	None---------	---	---	2.0-6.0	Apparent	Mar-Apr	>60	---	High.

* See map unit description for the composition and behavior of the map unit.

TABLE 16.--ENGINEERING TEST DATA

Soil name and location	Parent material	Report number BPR 73 Ind-83-	Depth	Moisture density: Maximum dry density	Moisture density: Optimum moisture content	Percentage passing sieve--: No. 4	No. 10	No. 40	No. 200	Percentage smaller than--: 0.05 mm	0.02 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index	Classification: AASHTO	Unified
			In	lb/cu ft	Pct									Pct			
Shipshe loam: Northeast corner sec. 17, T. 18 N., R. 9 W.	24 to 40 inches of loamy material over stratified, calcareous gravelly sand and sand.	1-1	0-8	104	19	100	97	85	77	64	16	14	11	40	14	A-6(10)	ML
		1-2	16-24	106	17	64	45	29	25	23	16	14	12	58	17	A-2-7 (1)	SM
		1-3	32-48	128	10	39	31	27	18	11	2	1	1	19	NP	A-1-b (0)	GM
Shipshe loam: Southeast corner sec. 33, T. 19 N., R. 9 W.	24 to 40 inches of loamy material over stratified, calcareous gravelly sand and sand.	2-1	0-8	103	19	98	97	89	83	72	17	15	10	38	12	A-6(9)	ML
		2-2	20-30	102	20	42	35	23	18	17	14	11	10	60	10	A-2-5 (0)	GM
		2-3	38-60	127	11	36	19	15	9	7	3	2	2	23	3	A-1-a (0)	GP-GM
Flanagan silt loam: Southeast corner sec. 16, T. 16 N., R. 9 W.	Loess over Wisconsin loam till.	3-1	0-12	103	19	100	100	98	93	82	22	19	15	34	13	A-6(9)	CL
		3-2	26-35	98	24	100	100	99	98	85	36	32	28	56	30	A-7-6 (19)	CH
		3-3	66-84	125	11	96	93	88	64	59	33	17	14	23	2	A-4(6)	ML
Flanagan silt loam: Southeast corner sec. 35, T. 16 N., R. 9 W.	Loess over Wisconsin loam till.	4-1	0-8	99	22	100	100	100	99	96	75	41	33	58	29	A-7-6 (19)	CH
		4-2	24-38	102	20	100	99	97	91	84	46	25	17	36	11	A-6(8)	ML
		4-3	60-85	120	13	96	93	90	66	53	36	17	11	27	9	A-4(6)	CL

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alford	Fine-silty, mixed, mesic Typic Hapludalfs
Armiesburg	Fine-silty, mixed, mesic Fluventic Hapludolls
Dana	Fine-silty, mixed, mesic Typic Argiudolls
Eel	Fine-loamy, mixed, nonacid, mesic Aquic Udifluvents
Elston	Coarse-loamy, mixed, mesic Typic Argiudolls
Fincastle	Fine-silty, mixed, mesic Aeric Ochraqualfs
Flanagan	Fine, montmorillonitic, mesic Aquic Argiudolls
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Genesee	Fine-loamy, mixed, nonacid, mesic Typic Udifluvents
Gosport	Fine, illitic, mesic Typic Dystrochrepts
Hennepin	Fine-loamy, mixed, mesic Typic Eutrochrepts
High Gap	Fine-loamy, mixed, mesic Typic Hapludalfs
Ipava	Fine, montmorillonitic, mesic Aquic Argiudolls
Martinsville	Fine-loamy, mixed, mesic Typic Hapludalfs
Miami	Fine-loamy, mixed, mesic Typic Hapludalfs
Ockley	Fine-loamy, mixed, mesic Typic Hapludalfs
Orthents	Loamy, mixed, mesic Udorthents
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Plano	Fine-silty, mixed, mesic Typic Argiudolls
Princeton	Fine-loamy, mixed, mesic Typic Hapludalfs
Proctor	Fine-silty, mixed, mesic Typic Argiudolls
Ragsdale	Fine-silty, mixed, mesic Typic Argiaquolls
Raub	Fine-silty, mixed, mesic Aquic Argiudolls
Reesville	Fine-silty, mixed, mesic Aeric Ochraqualfs
Rodman	Sandy-skeletal, mixed, mesic Typic Hapludolls
Rush	Fine-silty, mixed, mesic Typic Hapludalfs
Russell	Fine-silty, mixed, mesic Typic Hapludalfs
Sable	Fine-silty, mixed, mesic Typic Haplaquolls
Shadeland	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Shipshe	Loamy-skeletal, mixed, mesic Typic Argiudolls
Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Sleeth	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Starks	Fine-silty, mixed, mesic Aeric Ochraqualfs
Stonelick	Coarse-loamy, mixed (calcareous), mesic Typic Udifluvents
Tama	Fine-silty, mixed, mesic Typic Argiudolls
Wea	Fine-loamy, mixed, mesic Typic Argiudolls
Westland	Fine-loamy, mixed, mesic Typic Argiaquolls
Whitaker	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Xenia	Fine-silty, mixed, mesic Aquic Hapludalfs

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