United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
the Ohio Department of
Natural Resources,
Division of Soil and Water
Conservation, and the
Ohio Agricultural
Research and
Development Center

Soil Survey of Pike County, Ohio

How To Use This Soil Survey

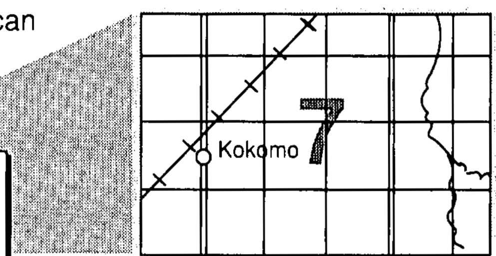
General Soil Map

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

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

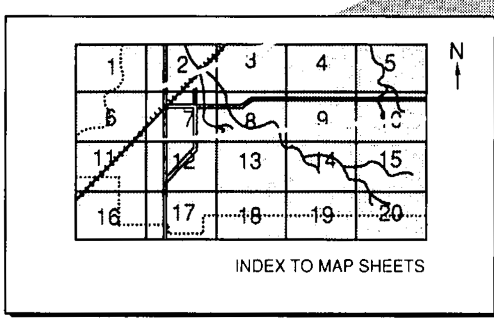
Detailed Soil Maps

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



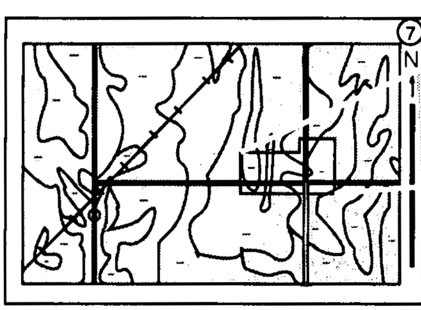
MAP SHEET

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

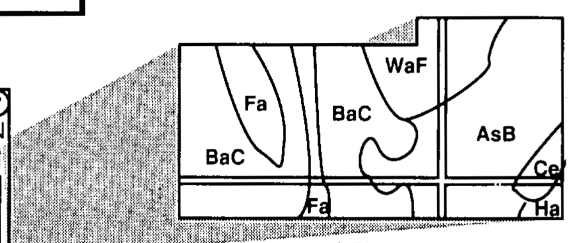


INDEX TO MAP SHEETS

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



MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Pike Soil and Water Conservation District. Financial assistance for this survey was provided by the Pike County commissioners.

Cover: Buildings on Markland silty clay loam, 8 to 15 percent slopes, eroded. This soil is moderately well suited to building site development.

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Issued June 1990

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Foreword

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

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

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

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

Joseph C. Branco
State Conservationist
Soil Conservation Service

Soil Survey of Pike County, Ohio

By Robert L. Hendershot, Soil Conservation Service

Fieldwork by Robert L. Hendershot, Thomas P. D'Avello, Richard M. Gehring, and Michael Plunkett, Soil Conservation Service

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

General Nature of the County

Pike County is in the south-central part of Ohio (fig. 1). The total area of the county is 283,648 acres, or 443 square miles. The population was 22,802 in 1980. In that year, the population of Waverly, the county seat, was 4,603 *(24)*.

The county is divided by the Scioto River, which enters the county at the northeast corner, flows south, and exits in the south-central part of the county. The village of Piketon is in the center of the county, in an area along the Scioto River. The village of Cynthiana is in the northwest corner of the county. The villages of Idaho and Latham are along Sunfish Creek in the western part of the county. The villages of Beaver and Stockdale are in the southeastern part.

The United States Department of Energy has a facility in the county. The plant, located 3 miles south of Piketon, is the largest employer in the county. Part of this facility was under construction during the survey period. Sand and gravel pits and construction firms are located south of Piketon, along the Scioto River. Several small manufacturing industries are located in Waverly. Several lumberyards and numerous small sawmills are in scattered areas throughout the county.

Cash-grain farming is the main agricultural enterprise in Pike County. Livestock and hay also are important farm products. Woodland is the major land use. Lake White State Park and Pike State Forest provide opportunities for a variety of outdoor recreation activities. Privately owned recreational areas are in the western part of the county.

Figure 1.—Location of Pike County in Ohio.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Pike County is cold in winter and quite hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and thus minimizes drought during summer on most soils. The normal annual precipitation is adequate for all of the crops that are suited to the temperature and growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Waverly Waste Water Station in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 32 degrees F, and the average daily minimum temperature is 22 degrees. The lowest temperature on record, which occurred on February 3, 1951, is -25 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 103 degrees.

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

The total annual precipitation is about 40 inches. Of this, nearly 23 inches, or about 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 3.59 inches on March 10, 1964. Thunderstorms occur on about 44 days each year. Tornadoes and severe thunderstorms occur occasionally. They are usually local in extent and of short duration and cause damage in scattered small areas.

The average seasonal snowfall is about 22 inches. The greatest snow depth at any one time during the period of record was 11 inches. On the average, 8 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 11 miles per hour, in spring.

Physiography, Relief, and Drainage

Pike County is on the deeply dissected part of the old Appalachian Plateau *(15)*. The county has been extensively dissected by drainageways. This plateau was originally dissected to the north, but during the glacial period, the drainage pattern reversed to the present system. Many of the old watercourses were modified or abandoned.

The extreme eastern part of the county has broad ridges and abrupt, steep hills with small streams in U-shaped valleys. Most of the central part of the county has narrow, sharp ridgetops, steep but gradual hillsides, and small V-shaped stream valleys. A broad, undulating peneplain that has some monadnock hills is in the central part. The western part of the county is characterized by broad, nearly level ridgetops and steep, gradual, benched hillsides with small V-shaped stream valleys. Abandoned preglacial stream valleys are in the southeastern, southern, northern, and northwestern parts of the county. These valleys were established during the period of the Teays drainage system. They were dammed and filled with drift as glacial ice advanced.

Nearly all of the county is drained by the Scioto River and its tributaries. Sunfish Creek is the principal tributary in the western part of the county. The rest of this part of the county is drained by Pee Pee and Long Fork Creeks in the north and Camp Creek in the south. Big Beaver Creek is the principal stream draining the eastern part of the county. Many areas in the northeastern part are drained by Carrs Run, Meadows Run, and numerous small channels. South Big Run and numerous small tributaries drain into the Scioto River. Bakers Fork, a tributary of Ohio Brush Creek, drains the northwest corner of the county. The southeast corner is drained by tributaries of the Little Scioto River.

Elevations range from 500 to 600 feet in the Scioto River Valley to over 1,330 feet on Greenbriar Ridge.

Geology

The bedrock in Pike County is sedimentary rock. The exposed strata consist of rocks of four geologic systems. They are of the Silurian, Devonian,

Figure 2.—Outcrops of the Sharon Conglomerate in an area of the Shelocta-Rigley association, steep.

Mississippian, and Pennsylvanian Systems. Generally, the rocks dip to the east and southeast.

The oldest exposed rock formations in the county are the Silurian dolomites. The Greenfield Formation of the Silurian System is exposed in the valley of Sunfish Creek between Latham and an area west of Byington. It also is exposed in the southwest part of the county. It is dense, hard dolomite *(12)*. In the western third of the county, the Ohio Shale Formation of the Devonian System is exposed. This is a thick, black, carbonaceous, thinly bedded shale formation *(9)*. The Bedford, Berea, Sunbury, Cuyahoga, and Logan Formations of the Mississippian System are throughout most of the county. They are mainly bluish gray, soft shale and resistant gray sandstone. The most striking geological feature in the county is the massive strata of Sharon Conglomerate in the Pottsville Group. This Pennsylvanian-age rock caps many hills in the eastern part of the county *(16)*. The Sharon Conglomerate normally contains many coarse quartz pebbles, but in places it has no pebbles (fig. 2).

The county has few natural outcrops. Resistant sandstones, especially the Berea Formation and the Buena Vista and Vinton members of the Logan Formation, form prominent benches and ledges. Commonly, the landscape is colluvial. Soft shales slough and slide downhill, undermining the sandstones which have broken off, and cover the hillsides with channery material.

The preglacial Teays River, which drained much of the southeastern United States, cut a valley across eastern Pike County. This abandoned valley is filled with Gallia sands, old alluvium, Minford silts, varved clay lacustrine sediments, local colluvium and alluvium, and loess *(17)*. Glaciers dammed the Teays channel, forming the Minford silts and Lake Tight.

The Newark River was formed after early glacial advances. It started in northeastern Ohio, and in Pike County it flowed through what is now the valley of the Scioto River. The channel of this river was deeper than that of the preglacial Teays River and than that of the present Scioto River. The small tributary streams also cut deeper into the valleys. During and following periods of glaciation, these small channels were filled with local colluvium and alluvial sediments.

During the later glacial advances, terraces of meltwater sediments were deposited in the Scioto River Valley. The oldest deposits are located along State Route 335 north of Waverly and in the Beech Flats area near Cynthiana. The later meltwater sediments were deposited throughout the Scioto River Valley. The only glacial till deposited in Pike County is along Massie Run in Perry Township *(5)*.

Settlement

Pike County was part of the Northwest Territory. It was a vast country of hills, valleys, dense woods, and streams *(8)*. Records dated 1700 and 1750 indicate that hostile Indian tribes drove Cherokees and Shawnees into this area. There were four tribes of Shawnees: the Shawnees, the Piquas, Masquachunks, and the Kiscapockes. Anthony Wayne and an army of 3,000 men began fighting the Indians in 1793. This conflict resulted in the Battle of Fallen Timbers and the Treaty of Greenville, which opened the area for settlement. By 1800, there were 30 log cabins along the Scioto River.

Pike County was organized in 1815 from areas of Adams, Scioto, and Ross Counties. The county was named after Zebulon Montgomery Pike, a Revolutionary War hero. Piketon was named the county seat. In 1817, the first mail was delivered to Piketon's post office by General James Rowe. The mail was carried on horseback down the Yoakums Trace, which ran from Chillicothe to Portsmouth *(8)*.

The Wood Industry

Pike County has approximately 25 sawmills, which produced 30,650,000 board feet in 1982. Four of the larger sawmills account for half of the county's total production. The county also has a railroad tie treatment plant. This plant treats approximately 1,000,000 ties per year. A large paper mill that uses an estimated 1,000,000 tons of wood per year is located in Ross County. These industries play a very important role in the economy of Pike County. Many residents of this county and the surrounding counties have jobs in the wood industry.

Most logging operations in Pike County use chainsaws to fell the trees. The logs then are skidded to landings by rubber-tired skidders or small crawlers. There the logs are cut into lengths, loaded onto logging trucks, and hauled to the mill. In some areas the logs are chipped on the harvest site and then taken to the paper mills.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

Survey Procedures

The general procedures followed in making this survey are described in the National Soil Handbook of the Soil Conservation Service. The soil maps made for conservation planning on individual farms prior to the start of the project soil survey, *The Water Resources of Pike County, Ohio (15)*, and *Mississippian Formations of Central and Southern Ohio (7)* were among the references used.

Before the fieldwork began, many preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs with a field scale of 1:15,840 (4 inches/mile). U.S. Geologic Survey topographic maps at a scale of 1:24,000 helped the soil scientists to relate land and image features. The soil scientists then made a reconnaissance of the county in a vehicle.

The soil scientists traversed the surface on foot, examining the soils. In areas where the soil pattern is very complex, such as the Omulga general soil map unit, traverses were as close as 200 yards. In areas where the soil pattern is relatively simple, such as the Shelocta-Brownsville general soil map unit, traverses were spaced about 0.25 mile or more apart.

As they traversed the surface, the soil scientists divided the landscape into segments based on use and management of the soils. For example, a knoll would be separated from a swale and a rolling ridgetop from a steep side slope. In most areas, soil examinations along the traverses were made at points 100 to 800 yards apart, depending on the landscape and soil pattern *(10)*.

Observations of such items as landforms, blown-down trees, vegetation, roadbanks, and animal burrows were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and aerial photo interpretation. The soil material was examined with the aid of a hand auger or a spade to a depth of about 6 feet or to bedrock within a depth of 6 feet. The pedons described as typical were observed and studied in pits that were dug with shovels and digging bars.

After completion of the soil mapping on aerial photographs, map unit delineations were transferred by hand to another set of aerial photographs taken in 1982 and 1983. Surface drainage was mapped in the field. Cultural features were recorded from observations of the maps and the landscape.

At the beginning of the survey, sample areas were selected to represent the major landscapes in the county. These areas were mapped at a rate roughly half that used in the rest of the county. Extensive notes were taken on the composition of map units in these preliminary study areas. As mapping progressed, these preliminary notes were modified and a final assessment of the composition of the individual map units was made. Many transects were made to determine the composition of soil associations, especially the Shelocta-Brownsville association, steep, and the Coolville-Blairton association, rolling, in the forested part of the county.

Samples for chemical and physical analyses and for analysis of engineering properties were taken from representative sites of several of the soils in the survey area. The chemical and physical analyses were made by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The results of the analyses are stored in a computerized data file at the laboratory. The analyses for engineering properties were made by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section, Columbus, Ohio. The laboratory procedures can be obtained by request from the two laboratories. The results of the studies can be obtained from the Department of Agronomy, Ohio State University; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Soil Conservation Service, State Office, Columbus, Ohio.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it 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 another but in a different pattern.

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

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

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts and the application of the latest soil classification system.

Soil Descriptions

1. Shelocta-Brownsville

Deep, moderately steep and steep, well drained soils formed in colluvium and residuum derived from sandstone, siltstone, and shale on hillsides in the uplands

This map unit consists of soils on uneven and benched hillsides. The landscape includes less sloping, narrow ridgetops, a few broad ridgetops, and some narrow stream valleys. Slopes range from 15 to 40 percent.

This map unit makes up about 43 percent of the county. It is about 35 percent Shelocta soils, 30 percent Brownsville soils, and 35 percent soils of minor extent.

The moderately steep and steep Shelocta soils are on foot slopes and the lower and middle parts of side slopes. They formed in colluvium and residuum derived from siltstone, sandstone, and shale. Permeability and the available water capacity are moderate.

The steep Brownsville soils are on the upper parts of side slopes and in areas above the benches. They formed mainly in residuum and colluvium derived from sandstone and siltstone. Permeability is moderate or moderately rapid. The available water capacity is low.

Blairton, Clifty, Haymond, Latham, Rarden, Rigley, and Trappist are the dominant soils of minor extent in this map unit. Blairton, Latham, Rarden, and Trappist soils are moderately deep over bedrock. Rigley soils have more sand in the subsoil and substratum than the major soils. Blairton soils are on ridgetops and shoulder slopes. Latham and Rarden soils are on ridgetops and hillsides. Rigley and Trappist soils are on hillsides. Clifty and Haymond soils formed in alluvium on narrow flood plains.

This map unit is used mainly as woodland. Some cleared areas on narrow ridgetops are used as cropland or pasture. Some abandoned farmland is now reverting to native pines. The steep areas are generally unsuited to cropland and pasture and are moderately well suited to woodland. The moderately steep areas are poorly suited to cropland, moderately well suited or poorly suited to pasture, and well suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less evaporation and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds and the sun. The soils on narrow ridgetops and flood plains are moderately well suited or well suited to cropland, pasture, and woodland. The steep soils are generally unsuited to building site development and septic tank absorption fields, and the moderately steep soils are poorly suited.

The slope, a very severe erosion hazard, the hazard of hillside slippage in areas of the Shelocta soils, and droughtiness in the Brownsville soils are the main management concerns.

2. Shelocta-Rigley

Deep, moderately steep and steep, well drained soils formed in colluvium and residuum derived from sandstone, shale, siltstone, and sandstone conglomerate on hillsides in the uplands

This map unit consists of soils on smooth hillsides that have a few benches and some sandstone escarpments. The landscape includes less sloping, broad and narrow ridgetops and some narrow stream valleys. Slopes range from 15 to 40 percent.

This map unit makes up about 5 percent of the county. It is about 45 percent Shelocta soils, 20 percent Rigley soils, and 35 percent soils of minor extent.

The moderately steep and steep Shelocta soils are generally on the middle and lower parts of side slopes and on foot slopes. They formed in colluvium and residuum derived from siltstone, sandstone, and shale. Permeability and the available water capacity are moderate. These soils are subject to hillside slippage.

The steep Rigley soils are generally on the upper concave parts of side slopes below sandstone and conglomerate escarpments. They formed in colluvium and residuum derived from sandstone conglomerate. Permeability is moderately rapid. The available water capacity is moderate.

Blairton, Brownsville, Clifty, Gilpin, Latham, Omulga, and Rarden are the dominant soils of minor extent in this map unit. Blairton, Gilpin, Latham, and Rarden soils are moderately deep over bedrock. Brownsville soils have a higher content of coarse fragments in the subsoil than the major soils. Blairton soils are on ridgetops and shoulder slopes. Brownsville soils are on hillsides. Gilpin, Latham, and Rarden soils are on ridgetops and hillsides. Clifty soils formed in alluvium on flood plains. Omulga soils have a fragipan. They are in preglacial valleys. Also of minor extent are areas of rock outcrop on the upper parts of the slopes.

Most areas of this map unit are used as woodland. Some areas on ridgetops are used as cropland or pasture. The steep soils are generally unsuited to cropland and pasture and are moderately well suited to woodland. The moderately steep soils are poorly suited to cropland, moderately well suited or poorly suited to pasture, and well suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less evaporation and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds and the sun. The soils on rolling ridgetops and narrow flood plains are moderately well suited or well suited to cropland, pasture, and woodland. These steep soils are generally unsuited to building site development and septic tank absorption fields, and the moderately steep soils are poorly suited.

The slope, a very severe erosion hazard, and the hazard of hillside slippage in areas of the Shelocta soils are main management concerns.

3. Shelocta-Latham

Deep and moderately deep, strongly sloping to steep, well drained and moderately well drained soils formed in colluvium and residuum derived from shale, siltstone, and sandstone on hillsides and ridgetops in the uplands

This map unit consists of soils on smooth slopes that have a few drainageways and seeps. The landscape includes many less sloping, narrow ridgetops, a few broad ridgetops, and some narrow stream valleys. Slopes range from 8 to 40 percent.

This association makes up about 12 percent of the county. It is about 35 percent Shelocta soils, 30 percent Latham soils, and 35 percent soils of minor extent.

The deep, moderately steep and steep, well drained Shelocta soils are on foot slopes and the middle and lower parts of side slopes. They formed in colluvium and residuum derived from siltstone, sandstone, and shale. Permeability and the available water capacity are moderate. These soils are subject to hillside slippage.

The moderately deep, strongly sloping to steep, moderately well drained Latham soils are on ridgetops and the upper parts of side slopes. They formed in colluvium and residuum derived from shale. Permeability is slow. The available water capacity is low. A seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. These soils have a high shrink-swell potential and are subject to hillside slippage.

Blairton, Brownsville, Clifty, Coolville, Gilpin, Haymond, and Omulga are the dominant soils of minor extent in this map unit. Blairton and Gilpin soils are moderately deep over bedrock. Brownsville soils have a higher content of coarse fragments in the subsoil than the major soils, and Coolville soils have fewer coarse fragments in the upper part. Blairton and Coolville soils are on ridgetops and shoulder slopes. Brownsville soils are on hillsides. Gilpin soils are on ridgetops and hillsides. Clifty and Haymond soils formed in alluvium on flood plains. Omulga soils have a fragipan. They are in preglacial valleys.

The steeper soils are used mainly as woodland or pasture. Some areas on narrow flood plains and ridgetops are used as cropland or pasture. Some abandoned farmland is reverting to brush and native pines. The steep soils are generally unsuited to cropland, pasture, building site development, and septic tank absorption fields. They are moderately well suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less evaporation and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds and the sun. The moderately steep and strongly sloping soils are moderately well suited or poorly suited to cropland and pasture and are moderately well suited or well suited to woodland. They are moderately well suited or poorly suited to building site development and are poorly suited to septic tank absorption fields.

The slope, hillside slippage, and a very severe erosion hazard are the main management concerns in the steeper areas of the major soils. Droughtiness, seasonal wetness, and the high shrink-swell potential of the Latham soils are additional concerns.

4. Trappist-Shelocta

Moderately deep and deep, moderately steep and steep, well drained soils formed in residuum and colluvium derived from shale, sandstone, and siltstone on hillsides in the uplands

This map unit consists of soils on uneven slopes that have sharp breaks at sandstone and shale bedrock escarpments and are broken by benches and drainageways. The landscape includes many less sloping ridgetops and narrow stream valleys. Slopes range from 15 to 40 percent.

This map unit makes up about 8 percent of the county. It is about 40 percent Trappist soils, 35 percent Shelocta soils, and 25 percent soils of minor extent.

The moderately deep Trappist soils are on foot slopes and the middle and lower parts of side slopes. They formed in colluvium and residuum derived from shale and sandstone. Permeability is moderately slow, and the available water capacity is low. Trappist soils are subject to hillside slippage.

The deep Shelocta soils are on foot slopes and the upper and middle parts of side slopes. They formed in colluvium and residuum derived from siltstone, sandstone, and shale. Permeability and the available water capacity are moderate. These soils are subject to hillside slippage.

Blairton, Bratton, Brownsville, Clifty, Coolville, Omulga, Opequon, and Tilsit are the dominant soils of minor extent in this map unit. The moderately deep Blairton and Bratton soils are on ridgetops and shoulder slopes. Brownsville soils have a higher content of coarse fragments in the subsoil than the major soils. They are on hillsides. Clifty soils formed in alluvium on flood plains. The moderately well drained Coolville soils are on ridgetops and shoulder slopes. Omulga and Tilsit soils have a fragipan. Omulga soils are in preglacial valleys. Tilsit soils are on ridgetops. The shallow Opequon soils are on shoulder slopes and side slopes. Also of minor extent are areas of rock outcrop on the upper parts of the slopes.

Most areas are used as woodland. Some areas on ridgetops have been cleared and are used as cropland or pasture. Some abandoned farmland is reverting to brush and native pines. The moderately steep soils on foot slopes are poorly suited or generally unsuited to cropland and are moderately well suited or poorly suited to pasture. The steep soils are generally unsuited to cropland, pasture, building site development, and septic tank absorption fields. They are moderately well suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less evaporation and cooler temperatures. These sites are less exposed to the drying effects of the prevailing wind and the sun.

The moderately steep and steep slopes, a very severe erosion hazard, and the hazard of slippage in areas of both the major soils and the moderate depth to bedrock, droughtiness, and moderately slow permeability of the Trappist soils are the main management concerns.

5. Coolville-Rarden-Tilsit

Deep and moderately deep, nearly level to moderately steep, moderately well drained and well drained soils formed in loess and sandstone, siltstone, and shale residuum on ridgetops and hillsides in the uplands

This map unit consists of soils on broad, smooth, uniform ridgetops and the adjoining shoulder slopes and hillsides. The landscape includes a few higher knobs on ridgetops and low, wide drainageways. Slopes range from 0 to 25 percent.

This map unit makes up about 10 percent of the county. It is about 35 percent Coolville soils, 30 percent Rarden soils, 25 percent Tilsit soils, and 10 percent soils of minor extent.

The deep, nearly level to rolling, moderately well drained Coolville soils are in broad areas on the ridgetops and on some shoulder slopes. They formed in loess and in the underlying material weathered from shale that has thin strata of siltstone. Permeability is moderate in the upper part of the profile and slow in the lower part. The available water capacity is moderate. A seasonal high water table is at a depth of 24 to 42 inches.

The moderately deep, strongly sloping to moderately steep, moderately well drained and well drained Rarden soils are on knobs on ridgetops and on hillsides. They formed in shale residuum. Permeability is slow. The available water capacity is low. These soils have a high shrink-swell potential and are subject to hillside slippage. They have a seasonal high water table at a depth of 24 to 36 inches.

The deep, nearly level and gently sloping, moderately well drained Tilsit soils are in broad areas on ridgetops. They formed in loess and in the underlying siltstone and sandstone residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is low above the fragipan. A seasonal high water table is at a depth of 18 to 30 inches during extended wet periods.

Brownsville and Shelocta soils on hillsides and Gilpin soils on hillsides and ridgetops are the dominant soils of minor extent in this map unit. All three soils have a higher content of coarse fragments in the upper part than the major soils.

Most areas are used as cropland or pasture. The Coolville and Tilsit soils are well suited or moderately well suited to cropland and pasture and are well suited to woodland. They are moderately well suited to building site development and poorly suited to septic tank absorption fields. The Rarden soils are moderately well suited, poorly suited, or generally unsuited to cropland, are moderately well suited or poorly suited to pasture, and are moderately well suited to woodland. They are moderately well suited, poorly suited, or generally unsuited to building site development and are poorly suited or generally unsuited to septic tank absorption fields.

The seasonal wetness and restricted permeability of all three soils are the main management concerns. The slope of the Coolville and Rarden soils and the high shrink-swell potential, slippage hazard, and moderate depth to bedrock in areas of the Rarden soils are additional concerns.

6. Omulga

Deep, nearly level to strongly sloping, moderately well drained soils formed in loess, colluvium, and old alluvium in preglacial valleys

This map unit consists of soils in valleys of abandoned, preglacial drainage systems. The valleys are generally broad and as much as 1.5 miles across. Slopes range from 0 to 15 percent.

This map unit makes up about 15 percent of the county. It is about 50 percent Omulga and similar soils and 50 percent soils of minor extent.

Omulga soils are on slight rises, at the head of drainageways, in high saddles, and on side slopes in the valleys. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is low above the fragipan. A seasonal high water table is at a depth of 24 to 42 inches during extended wet periods.

The somewhat poorly drained Doles soils and the Markland, McGary, Melvin, Montgomery Variant, Negley, Orrville, Parke, Peoga, Purdy Variant, Richland, Stendal, Taggart, Wilbur, and Wyatt soils are the dominant soils of minor extent in this map unit. Doles soils are the only minor soils in which part of the subsoil is a fragipan. Doles and Purdy Variant soils are in depressions in preglacial valleys. McGary soils are on flats and Wyatt soils on knolls and side slopes in preglacial valleys. Markland soils are on lacustrine terraces. Negley soils are on knolls, at the head of drainageways, and on side slopes on outwash terraces. Parke soils are on Illinoian outwash plains and terraces. Peoga soils are in depressions and Taggart soils in slightly depressed areas on Illinoian outwash plains and terraces. Melvin, Montgomery Variant, Orrville, Stendal, and Wilbur soils are on flood plains. Richland soils are on foot slopes in preglacial valleys.

Most areas are used as cropland or pasture. The Omulga soils are well suited or moderately well suited to cropland and pasture and are well suited to woodland. They are moderately well suited to building site development and poorly suited to septic tank absorption fields. They are better suited to dwellings without basements than to dwellings with basements.

The seasonal wetness, a moderate shrink-swell potential, the slow permeability, and the slope and erosion hazard in the more sloping areas are the main management concerns.

7. Genesee-Huntington-Fox

Deep, nearly level to strongly sloping, well drained soils formed in alluvium on flood plains and in glacial outwash on terraces

This map unit consists of soils on wide flood plains and terraces. Sharp slope breaks are between the flood plains and terraces. Slopes are smooth and uniform and range from 0 to 12 percent.

This map unit makes up about 7 percent of the county. It is about 30 percent Genesee soils, 15 percent Huntington soils, 15 percent Fox soils, and 40 percent soils of minor extent.

The nearly level Genesee soils are on the lowest level of the flood plains closest to the streams. They formed in alluvium. Permeability is moderate, and the available water capacity is high.

The nearly level Huntington soils are slightly higher on the flood plains than the Genesee soils. Permeability is moderate, and the available water capacity is high.

The nearly level to strongly sloping Fox soils are on slope breaks and the more nearly level parts of outwash terraces. They formed in loamy outwash over outwash of sand and gravel. Permeability is moderate in the subsoil and rapid or very rapid in the substratum. The available water capacity is low or moderate.

The somewhat poorly drained Orrville soils in high water channels and Elkinsville, Martinsville, and Taggart soils on low stream terraces are the dominant soils of minor extent in this map unit. Elkinsville and Martinsville soils have less gravel in the upper part than the Fox soils and have a subsoil in which clay has accumulated. Taggart soils are somewhat poorly drained.

Most areas are used for cultivated crops or small grain. Narrow strips adjacent to streams are wooded. The major soils are well suited or moderately well suited to cultivated crops. They are well suited to pasture and woodland. The Genesee and Huntington soils are better suited to cropland than the Fox soils, which are subject to erosion and are droughty. The Genesee and Huntington soils are generally unsuitable as sites for buildings and septic tank absorption fields because of a flooding hazard. The Fox soils are well suited to building site development and septic tank absorption fields.

The flooding on the Genesee and Huntington soils is the main management concern. It generally occurs during periods when plants are dormant. Droughtiness and the erosion hazard limit the use of the Fox soils for crops. Because of the rapid or very rapid permeability in the substratum of the Fox soils, the effluent from septic tank absorption fields can pollute ground water.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Omulga silt loam, 3 to 8 percent slopes, is a phase of the Omulga series.

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

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Latham-Wharton silt loams, 15 to 25 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Shelocta-Brownsville association, steep, is an example.

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

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

The names, descriptions, and delineations of the soils in this survey may differ from those of adjoining soils in adjacent counties. Most differences result from a better knowledge of soils or from modifications and refinements in the concepts of soil series. Some differences result from the predominance of different soils in map units consisting of soils of two or more series and from variations in slope range allowed in the map units in the different surveys.

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

Soil Descriptions

AgD—Allegheny Variant loam, 15 to 25 percent slopes. This deep, moderately steep well drained soil is on hillsides along drainageways in preglacial valleys.

Slopes are generally smooth and are cut by a few minor drainageways. Most areas are long and narrow and are 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown and brown, friable loam about 10 inches thick. The subsurface layer is brown, friable loam about 8 inches thick. The subsoil is about 26 inches thick. The upper part is yellowish brown, firm loam, and the lower part is strong brown, firm loamy sand. The substratum to a depth of about 63 inches is strong brown, loose loamy sand. In a few areas the subsoil has more sand and less clay. In some areas the soil is strongly sloping.

Included with this soil in mapping are small areas of Melvin, Omulga, Stendal, and Wyatt soils. The poorly drained Melvin and somewhat poorly drained Stendal soils are on flood plains. The moderately well drained Omulga and Wyatt soils are on side slopes in the preglacial valleys. Also included are severely eroded soils on side slopes. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the upper part of the Allegheny Variant soil and moderately rapid or rapid in the lower part. The available water capacity is moderate. Runoff is rapid. The subsoil is strongly acid to extremely acid. The organic matter content is moderately low. The potential for frost action is moderate.

Most areas are wooded. This soil is well suited to woodland. The north- and east-facing slopes are better sites for woodland than south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Erosion is a moderate hazard if the ground cover is removed. The slope limits the use of equipment. Building logging roads and skid trails on or nearly on the contour facilitates the use of equipment and minimizes erosion. Water bars or other measures that control runoff and erosion are needed. Tracked equipment is better suited than wheeled equipment.

A few areas are used as hayland. This soil is poorly suited to corn, wheat, and hay. Erosion is a severe hazard in cultivated areas. Measures that maintain tilth and organic matter content are needed. The cropping system should be dominated by meadow crops. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year is needed.

A few areas are pastured. This soil is poorly suited to pasture. The short, moderately steep slopes limit the use of most kinds of wheeled equipment. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species.

This soil is poorly suited to dwellings and septic tank absorption fields because of the slope. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in most areas. If the less sloping areas are leveled during building site development, a retaining wall is needed to prevent the downslope movement of the soil. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Local roads should be built across the slope. Ground water pollution is a hazard if the distribution lines of septic tank absorption fields are installed too deep in the soil. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the soil surface.

The woodland ordination symbol is 4R. The land capability classification is IVe. The pasture and hayland suitability group is A-2.

BdC—Blairton-Rarden-Gilpin association, rolling. This association consists of moderately deep soils on uplands. The moderately well drained Blairton soil is on convex shoulder slopes, the moderately well drained and well drained Rarden soil is on the wider parts of ridgetops, and the well drained Gilpin soil is on higher parts of the ridgetops. Slopes are dominantly 5 to 20 percent. They are generally smooth, but some are undulating. Areas are long and narrow and range from 30 to 300 acres in size. Most are about 30 percent Blairton silt loam, 25 percent Rarden silt loam, and 20 percent Gilpin channery silt loam. Because of present and anticipated land uses, it was not considered practical or necessary to separate these soils at the scale used in mapping.

Typically, the Blairton soil has partially decomposed leaf litter at the surface. The surface layer is dark grayish brown, very friable silt loam about 1 inch thick. The subsurface layer is yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 35 inches thick. It is yellowish brown, firm silt loam in the upper part, and yellowish brown and strong brown, mottled, very firm channery silty clay loam in the lower part. Soft siltstone bedrock is at a depth of about 40 inches. In a few areas the soil is underlain by hard bedrock. In a few places the subsoil is silty clay or clay above the bedrock. In some areas the soil is well drained.

Typically, the Rarden soil has a surface layer of dark yellowish brown, friable silt loam about 6 inches thick. The subsoil is about 20 inches thick. The upper part is strong brown, firm silty clay loam and silty clay, and the lower part is strong brown and yellowish red, mottled, firm clay. Strong brown and light gray, soft, thinly bedded shale is at a depth of about 26 inches. In some areas the subsoil has more silt. In a few areas the soil is deep over bedrock.

Typically, the Gilpin soil has partially decomposed leaf litter at the surface. The surface layer is dark grayish brown, very friable channery silt loam about 2 inches thick. The subsoil is about 24 inches thick. The upper part is yellowish brown, friable silt loam and strong brown, firm channery loam, and the lower part is strong brown, mottled, firm loam. Soft sandstone bedrock is at a depth of about 26 inches. In a few areas the soil is moderately well drained. In some areas the subsoil has a higher content of coarse fragments and less clay.

Included with these soils in mapping are areas of Brownsville, Rigley, and Tilsit soils; shallow soils; and deep, well drained, silty soils. Brownsville and Rigley soils are in the more sloping areas. Brownsville soils have a higher content of coarse fragments in the subsoil than the Blairton, Rarden, and Gilpin soils, and Rigley soils have more sand in the subsoil. Tilsit soils and the deep, well drained, silty soils are in saddles on the broad, more nearly level parts of ridgetops. Tilsit soils have a fragipan. The shallow soils are on shoulder slopes. Areas of the minor soils are less than 20 acres in size. They make up about 25 percent of the association.

Permeability is moderately slow in the Blairton soil, slow in the Rarden soil, and moderate in the Gilpin soil. The available water capacity is low in all three soils. Runoff is medium or rapid, depending on the slope. The subsoil is extremely acid to strongly acid in the Blairton and Gilpin soils and extremely acid to medium acid in the Rarden soil. The root zone generally is moderately deep in all three soils. The organic matter content is moderately low. The potential for frost action is high in the Blairton and Rarden soils and moderate in the Gilpin soil. The shrink-swell potential is high in the Rarden soil and low in the Blairton and Gilpin soils. The seasonal high water table is at a depth of 24 to 42 inches in the Blairton soil, 24 to 36 inches in the Rarden soil, and more than 6 feet in the Gilpin soil.

Most areas are wooded. These soils are moderately well suited to woodland. Careful site preparation following a harvest helps to ensure the development of the new stand. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard on the Rarden soil. Planting seedlings that have been transplanted once reduces the seedling mortality rate on this soil. The hazard of erosion on the Rarden soil can be reduced by locating logging roads and skid trails on or nearly on the contour and by using water bars. Building logging roads on the contour also facilitates the use of equipment.

A few areas are used as cropland. These soils are poorly suited to corn, soybeans, wheat, and hay. Most areas are too narrow for the efficient use of large farming equipment. Erosion is a severe hazard in cultivated areas. No-till planting or another system of conservation tillage that leaves crop residue on the surface helps to control erosion, improves tilth, and increases the organic matter content. Grassed waterways help to prevent gully erosion where runoff concentrates.

A few areas are pastured. These soils are moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. The slope limits the use of some wheeled equipment. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction. Frost action in the Blairton and Rarden soils may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone.

These soils are moderately well suited to dwellings. They are better suited to dwellings without basements than to dwellings with basements. Reinforcing foundations and footings minimizes the structural damage caused by slippage and shrinking and swelling in the Rarden soil. Subsurface drains around foundations reduce the wetness of the Blairton and Rarden soils. Land grading improves surface drainage. Buildings should be designed so that they conform to the natural slope of the land. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective wall coating around footings helps to control corrosion of concrete. Providing suitable base material minimizes the damage to local roads and streets caused by frost action in all three soils and by low strength in the Rarden soil. Installing a drainage system minimizes the damage caused by frost action in the Blairton and Rarden soils.

These soils are poorly suited to septic tank absorption fields. Installing the distribution lines on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption field and installing perimeter subsurface drains help to overcome the restricted permeability and wetness in the Blairton and Rarden soils. Installing the distribution lines in a mound of suitable fill material also helps to overcome these limitations. Land grading improves surface drainage. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol assigned to the Blairton and Gilpin soils is 4A, and the one assigned to the Rarden soil is 3R. The land capability classification is IVe. The pasture and hayland suitability group is F-1.

BrB2—Bratton silt loam, 3 to 8 percent slopes, eroded. This moderately deep, gently sloping, well drained soil is on ridgetops in the uplands. Slopes are typically smooth and slightly convex. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are long and narrow and are 10 to 50 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is strong brown, firm silty clay loam; the next part is yellowish red, firm silty clay; and the lower part is yellowish red and reddish brown, firm clay. The substratum is light yellowish brown, mottled, loose channery fine sandy loam. Hard dolomitic limestone bedrock is at a depth of about 38 inches. In some places the soil is deep over bedrock. In other places it is strongly sloping. In a few areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of deep, well drained and moderately well drained soils that have a fragipan. These soils are along drainageways. Also included are small areas of Latham, Opequon, and Trappist soils. Latham soils are moderately well drained. The shallow Opequon soils are on slope breaks. Trappist soils are more acid in the lower part than the Bratton soil. Included soils make up about 10 percent of most mapped areas.

Permeability is moderately slow in the upper part of the Bratton soil and rapid directly above the bedrock. The available water capacity is low. Runoff is medium. The root zone is moderately deep. The subsoil is strongly acid to mildly alkaline. The organic matter content is moderately low.

A few areas are reverting to woodland. The vegetative cover in most areas is grasses and pioneer tree species. This soil is well suited to woodland. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil. The species selected for planting should be those that grow well in a soil that has bedrock at a depth of 20 to 40 inches.

Most areas have been cleared of trees and a few areas are used as cropland. This soil is moderately well suited to corn, soybeans, and wheat and to grasses and legumes for hay. Erosion is a moderate hazard in cultivated areas. The soil can be cultivated year after year if erosion is controlled and the soil is otherwise well managed. No-till planting or another system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, and the incorporation of crop residue into the plow layer help to control erosion, improve tilth, and increase the organic matter content. Grassed waterways help to prevent gully erosion where runoff concentrates. Tilling within the proper range of moisture content minimizes compaction.

A few areas are pastured. This soil is moderately well suited to pasture. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone and the low available water capacity. Erosion can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods helps to prevent compaction.

This soil is moderately well suited to dwellings. It is better suited to dwellings without basements than to dwellings with basements. The bedrock limits excavations for basements and utility lines. Backfilling the excavations around foundations and footings with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. A drainage system and suitable base material minimize the damage to local roads and streets caused by low strength.

This soil is poorly suited to septic tank absorption fields because of the moderate depth to bedrock and the moderately slow permeability. Effluent moves laterally through the rapidly permeable layer above the bedrock. Installing the distribution lines in a mound of suitable fill material and enlarging the absorption area help to elevate the field above the bedrock and help to overcome the restricted permeability.

The woodland ordination symbol is 4A. The land capability classification is IIe. The pasture and hayland suitability group is F-1.

Cf—Clifty silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains in narrow valleys. Slopes are 0 to 2 percent. Most areas are 100 to 250 feet wide, are as much as 2 miles long, and are 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is brown and yellowish brown, friable silt loam about 5 inches thick. The subsoil is yellowish brown, friable gravelly loam about 18 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable very gravelly loam. In some areas the subsoil has more silt.

Included with this soil in mapping are small areas of Skidmore Variant soils on alluvial fans and stream terraces. These soils have a higher content of coarse fragments in the subsoil than the Clifty soil. Also included are small areas of Elkinsville soils on low stream terraces and narrow strips of Shelocta soils on foot slopes. Elkinsville soils have more silt and fewer coarse fragments in the subsoil than the Clifty soil. Shelocta soils have a higher content of angular coarse fragments in the subsoil than the Clifty soil. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately rapid in the Clifty soil. The root zone is deep. The available water capacity is low or moderate. Runoff is slow. The subsoil is very strongly acid to medium acid. The organic matter content is moderately low.

Some areas are wooded. Generally, these areas are narrow and irregularly shaped and are along meandering streams. This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas are used as cropland. This soil is well suited to corn, small grain, and tobacco (fig. 3) and to grasses and legumes for hay. The soil can be intensively cropped if improved management is applied. Droughtiness and flooding are the major management concerns. Stabilizing eroding streambanks is difficult in most places. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Tilling within the optimum range of moisture content, incorporating crop residue into the plow layer, including grasses and legumes in the cropping sequence, and applying a system of conservation tillage that leaves crop residue on the surface most of the year improve tilth, minimize surface crusting, and increase the infiltration rate. Leaving a cover crop or stubble in the field throughout the winter helps to control the erosion caused by floodwater.

Some areas are pastured. This soil is well suited to pasture. The deposition of sediment by floodwater reduces the quality of the forage. The soil is droughty in the summer. Warm-season grasses, such as switchgrass, big bluestem, indiangrass, and Caucasin bluestem, grow well on droughty soils. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes soil compaction.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding and the hazard of ground water pollution. Overcoming the flooding hazard is very costly.

The woodland ordination symbol is 3A. The land capability classification is IIw. The pasture and hayland suitability group is A-5.

CoB—Coolville silt loam, 1 to 8 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is mainly on broad ridgetops in the uplands. Slopes are smooth and uniform. Most areas are irregularly shaped and are 25 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is yellowish brown and light yellowish brown, friable silt loam and silty clay loam and firm silty clay, and the lower part is red, strong brown, and yellowish brown, firm silty clay loam and silty clay. The subsoil is mottled below a depth of about 15 inches. Soft, yellowish brown shale is at a depth of about 48 inches. In some areas the clayey material is closer to the surface. In other areas the subsoil has less clay.

Included with this soil in mapping are small areas of Blairton and Tilsit soils. The moderately deep Blairton soils are on slight rises and along the edges of the map unit. They have less clay in the subsoil than the Coolville soil. Tilsit soils occur in a random pattern throughout most areas. They have a fragipan. Included soils make up 10 to 15 percent of most mapped areas.

Permeability is moderate in the upper part of the Coolville soils and slow in the lower part. The available water capacity is moderate. Runoff is slow or medium. The potential for frost action is high. The subsoil is

Figure 3.—Tobacco on Clifty silt loam, occasionally flooded.

strongly acid to extremely acid. The seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. The organic matter content is moderately low.

Many areas on narrow ridgetops are wooded. This soil is well suited to woodland. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Most areas are used as cropland. This soil is well suited to row crops, to small grain, and to grasses and legumes for hay. The erosion hazard is moderate in cultivated areas. Cultivated crops can be grown year after year if erosion is controlled and improved management is applied. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Including grasses and legumes in the cropping sequence and incorporating crop residue into the plow layer increase the infiltration rate, minimize surface crusting, and help to maintain tilth and the organic matter content. Cover crops, contour farming, and no-till or another system of conservation tillage that leaves crop residue on the surface most of the year help to control erosion. Grassed waterways help to prevent gully erosion where runoff concentrates. Tilling within the proper range of moisture content minimizes compaction. In some areas the soil dries out slowly in spring. Subsurface drains help lower the seasonal high water table in these wet areas.

Some areas are pastured. This soil is well suited to pasture. Proper stocking rates, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes soil compaction. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is moderately well suited to dwellings. It is better suited to dwellings without basements than to dwellings with basements. Reinforcing foundations and footings and backfilling along foundations with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. Designing walls that have pilasters and are reinforced with concrete or supporting the walls on large spread footings also minimizes this damage. Installing subsurface drains around foundations and coating the exterior of basement walls help to keep basements dry. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective wall coating around footings minimizes the corrosion of concrete. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and low strength.

This soil is poorly suited to septic tank absorption fields because of the slow permeability in the lower part of the subsoil and the seasonal wetness. Enlarging the absorption field helps to overcome the slow permeability. Installing perimeter subsurface drains helps to lower the seasonal high water table. Land grading improves surface drainage. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4A. The land capability classification is IIe. The pasture and hayland suitability group is A-6.

CoC—Coolville silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on ridgetops and shoulder slopes in the uplands. Slopes are smooth and uniform. Most areas are long and narrow and are 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is yellowish brown and light yellowish brown, friable silt loam and silty clay loam and firm silty clay, and the lower part is red, strong brown, and yellowish brown, firm silty clay loam and silty clay. The subsoil is mottled below a depth of about 18 inches. Soft, yellowish brown shale bedrock is at a depth of about 48 inches. In some areas the clayey material is closer to the surface. In other areas the subsoil has less clay. In a few areas the soil is moderately steep.

Included with this soil in mapping are small areas of Blairton and Tilsit soils. The moderately deep Blairton soils are on slight rises and along the edges of the map unit. They have less clay in the subsoil than the Coolville soil. Tilsit soils are in the less sloping areas. They have a fragipan. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the upper part of the Coolville soil and slow in the lower part. The available water capacity is moderate. Runoff is rapid. The potential for frost action is high. The subsoil is strongly acid to extremely acid. The water table is at a depth of 24 to 42 inches during wet periods. The organic matter content is moderately low.

Many areas are wooded. This soil is well suited to woodland. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Building logging roads and skid trails on the contour in the included moderately steep areas minimizes runoff and erosion.

Some areas are used for row crops, for small grain, or for grasses and legumes for hay. This soil is moderately well suited to cropland. Erosion is a severe hazard in cultivated areas. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. A system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, grassed waterways, and a cropping sequence that includes grasses and legumes increase the infiltration rate, minimize surface crusting, improve tilth, increase the organic matter content, and help to control erosion. Tilling within the proper range of moisture content minimizes soil compaction.

Some areas are pastured. This soil is moderately well suited to pasture. If the pasture is plowed for seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes from frost heaving. The slope may limit the use of some equipment.

This soil is moderately well suited to dwellings. It is better suited to dwellings without basements than to dwellings with basements. Reinforcing foundations and footings minimizes the structural damage caused by shrinking and swelling. Installing subsurface drains around foundations and coating the exterior of basement walls help to keep basements dry. Buildings should be designed so that they conform to the natural slope of the land. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective wall coating around footings minimizes the corrosion of concrete. Maintaining a protective cover of vegetation on the site during construction helps to control erosion. Installing a drainage system and providing suitable base material minimizes the damage to local roads and streets caused by the high potential for frost action and by low strength.

This soil is poorly suited to septic tank absorption fields because of the slow permeability in the lower part of the subsoil and the seasonal wetness. Enlarging the absorption field helps to overcome the slow permeability. Installing perimeter subsurface drains helps to lower the seasonal high water table. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent seepage of effluent to the surface. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4A. The land capability classification is IIIe. The pasture and hayland suitability group is A-6.

CpC—Coolville-Blairton association, rolling. This association consists of a deep, moderately well drained, Coolville soil and moderately deep, moderately well drained Blairton soil on narrow ridgetops and shoulder slopes. The Coolville soil is on the flatter, wider parts of the ridgetops, and the Blairton soil is on convex shoulder slopes and the higher parts of the ridgetops. Slopes are dominantly 5 to 20 percent. They are generally smooth, but some are undulating. Most areas are long and narrow and are 40 to 250 acres in size. A few areas are broad. Most areas are about 50 percent Coolville silt loam and 30 percent Blairton silt loam. Because of present and anticipated land uses, it was not considered practical or necessary to separate these soils at the scale used in mapping.

Typically, the Coolville soil has partially decomposed leaf litter at the surface. The surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is yellowish brown and light yellowish brown, friable silt loam and silty clay loam and firm silty clay, and the lower part is red, strong brown, and yellowish brown, firm silty clay loam and silty clay. The subsoil is mottled below a depth of about 14 inches. Soft, yellowish brown shale bedrock is at a depth of about 48 inches. In some areas the clayey material is closer to the surface. In other areas the subsoil has less clay. In a few places flagstones are on the surface.

Typically, the Blairton soil has partially decomposed leaf litter at the surface. The surface layer is dark grayish brown, very friable silt loam about 1 inch thick. The subsurface layer is yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, firm silt loam, and the lower part is yellowish brown and strong brown, mottled, very firm channery silty clay loam. Soft, fractured siltstone bedrock is at a depth of about 40 inches. In some areas the soil is deep over bedrock. In a few areas it is underlain by hard bedrock. In a few places the texture is silty clay or clay directly above the bedrock. In some areas the upper part of the subsoil has no coarse fragments. In a few areas the soil is well drained.

Included with these soils in mapping are areas of Brownsville and Tilsit soils and some areas of soils that are well drained, stony, and shallow or moderately deep. Brownsville soils are on shoulder slopes. They have a higher content of coarse fragments in the subsoil than the Coolville and Blairton soils. Tilsit soils have a fragipan. They are on the broad, more nearly level parts of ridgetops. The soils that are well drained, stony, and shallow or moderately deep are on very narrow ridgetops and peaks. Areas of the included soils are less than 20 acres in size. They make up about 20 percent of the association.

Permeability is moderate in the upper part of the Coolville soil and slow in the lower part. It is moderately slow in the Blairton soil. The available water capacity is moderate in the Coolville soil and low in the Blairton soil. Runoff is medium or rapid on both soils, depending on the slope. The potential for frost action is high. The subsoil is strongly acid to extremely acid. The seasonal high water table is at a depth of 24 to 42 inches. The organic matter content is moderately low.

Most areas are wooded. These soils are well suited to woodland. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard on the included shallow soils.

Very few areas are cropped. These soils are moderately well suited to cropland. Most areas are too narrow for the efficient use of large farming equipment. Erosion is a severe hazard in cultivated areas. A cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves crop residue on the surface, and tillage at the proper moisture content help to maintain tilth and the organic matter content and minimize crusting. Grassed waterways help to prevent gully erosion where runoff concentrates.

A few areas are pastured. These soils are moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a hazard. It can be controlled by no-till seeding or by growing a companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help maintain the stand of key forage species. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone in the Blairton soil and the acid root zone of both soils. Limited grazing during winter and other wet periods minimizes compaction. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixtures helps to protect the legumes against frost heaving.

These soils are moderately well suited to dwellings. Because of the seasonal wetness, they are better suited to dwellings without basements than to dwellings with basements. Reinforcing foundations and footings minimizes the structural damage caused by shrinking and swelling of the Coolville soil. Installing subsurface drains around foundations and coating the exterior of basement walls help to keep basements dry. Properly landscaping building sites helps to divert surface water away from foundations. Buildings should be designed so that they conform to the natural slope of the land. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective wall coating around footings minimizes the corrosion of concrete. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action in both soils and by low strength in the Coolville soil.

These soils are poorly suited to septic tank absorption fields because of the restricted permeability, the seasonal wetness and the depth to bedrock. Enlarging the absorption field helps to overcome the restricted permeability. Installing perimeter subsurface drains helps to lower the seasonal high water table. Installing the distribution lines in a mound of suitable fill material improves the filtering capacity in areas of the Blairton soil. Land grading improves surface drainage. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4A. The land capability classification is IIIe. The pasture and hayland suitability group is A-6 for the Coolville soil and F-1 for the Blairton soil.

DoA—Doles silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is in slight depressions and along intermittent drainageways in preglacial valleys. Slopes are typically smooth and uniform. Most areas are irregularly shaped and are 5 to 150 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 61 inches thick. The upper part is light yellowish brown, mottled, friable silt loam and light brownish gray, mottled, friable silty clay loam; the next part is a fragipan of yellowish brown, mottled, very firm silt loam; and the lower part is yellowish brown, mottled, firm silt loam. In some areas the subsoil has more sand. In a few areas the soil is poorly drained. In a few places it is gently sloping.

Included with this soil in mapping are small areas of the moderately well drained Wyatt and Omulga soils on slight rises. Also included are small areas of soils that have more clay in the subsoil than the Doles soil. These soils do not have a fragipan. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Doles soil. The root zone is mainly restricted to the 20- to 30-inch zone above the fragipan. The available water capacity of this zone is low. The subsoil is very strongly acid to medium acid. Runoff is slow. The potential for frost action is high. The seasonal high water table is at a depth of 12 to 24 inches. The organic matter content is moderately low.

A few areas are wooded. This soil is well suited to woodland. No hazards or limitations affect planting or harvesting.

This soil is used mainly as cropland. It drained, it is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. It dries out slowly in spring. Installing subsurface drains helps to lower the seasonal high water table in most areas. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Minimizing tillage, including grasses and legumes in the cropping sequence, and incorporating crop residue into the plow layer increase the infiltration rate, minimize surface crusting, and help to maintain tilth and the organic matter content. Cover crops and a system of conservation tillage that leaves crop residue on the surface most of the year help to control erosion. Grassed waterways help to prevent gully erosion where runoff concentrates. Tilling within the proper range of moisture content minimizes compaction.

A few areas are pastured. If drained, this soil is well suited to pasture, but it is poorly suited to grazing early in spring. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Maintaining stands of deep-rooted legumes is difficult because of the fragipan at a depth of 20 to 30 inches and the acid root zone. Limited grazing during winter and other wet periods minimizes compaction.

This soil is poorly suited to dwellings. Because of the wetness, it is better suited to dwellings without basements than to dwellings with basements. Installing subsurface drains around foundations and footings and coating the exterior of basement walls help to keep basements dry. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and low strength.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. Properly landscaping the absorption field helps to divert surface water away from the field. Enlarging the absorption field and replacing the fragipan with more permeable material help to overcome the slow permeability. Perimeter subsurface drains help to lower the water table. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4A. The land capability classification is IIw. The pasture and hayland suitability group is C-2.

En—Elkinsville silt loam, rarely flooded. This deep, nearly level, well drained soil is on low stream terraces. It is subject to rare flooding during periods when runoff is very high. Slopes are typically smooth and uniform. They are 0 to 2 percent. Most areas are irregularly shaped and are 10 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 12 inches thick. The subsoil is about 56 inches thick. The upper part is dark yellowish brown, firm silt loam; the next part is dark yellowish brown and strong brown, firm silty clay loam; and the lower part is yellowish brown, firm silty clay loam. The substratum to a depth of about 71 inches is yellowish brown, mottled, friable silt loam. In some areas the surface layer is darker. In places the lower part of the subsoil is mottled.

Included with this soil in mapping are small areas of Fox, Genesee, Haymond, Huntington, Martinsville, and Taggart soils. Fox and Martinsville soils have more sand in the subsoil than the Elkinsville soil. They are near slope breaks. Genesee, Haymond, and Huntington soils are on flood plains. Genesee and Haymond soils have less clay in the subsoil than the Elkinsville soil, and Huntington soils have a darker surface layer. The somewhat poorly drained Taggart soils are in depressions and drainageways. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Elkinsville soil. The available water capacity is high. Runoff is slow. The subsoil is very strongly acid to slightly acid. The potential for frost action is high. The organic matter content is moderately low.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil.

Most areas have been cleared of trees and are used as cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. The erosion hazard is slight in cultivated areas. Maintaining tilth and the organic matter content is the main management concern. The surface layer crusts after heavy rainfall. The crusting reduces the rate of water infiltration and inhibits seedling emergence. A system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes help to control erosion, improve tilth, increase the infiltration rate and the organic matter content, and minimize crusting. Tilling within the proper range of moisture content minimizes compaction.

A few areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes from frost heaving. Limited grazing during winter and other wet periods minimizes compaction.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding. Overcoming this hazard is very costly. The soil is well suited to recreational uses, such as picnic areas, hiking trails, and golf fairways. The flooding occurs mainly during periods when these recreational areas are not used.

The woodland ordination symbol is 5A. The land capability classification is I. The pasture and hayland suitability group is A-6.

ErC—Ernest silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on colluvial foot slopes along the edges of preglacial valleys. Slopes are typically uneven and are dissected by many small drainageways. Most areas are elongated and are 10 to 50 acres in size.

Typically, the soil has partially decomposed leaf litter at the surface. The surface layer is dark yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 64 inches thick. The upper part is yellowish brown, firm silt loam and channery silty clay loam; the next part is a fragipan of yellowish brown, very firm and brittle silt loam; and the lower part is yellowish brown and strong brown, firm silty clay loam. The subsoil is mottled below a depth of about 15 inches. In some areas the fragipan is lower in the profile. In a few areas the subsoil has more silt and a lower content of sand and coarse fragments.

Included with this soil in mapping are small areas of Clifty, Shelocta, and Wilbur soils, which do not have a fragipan. Clifty and Wilbur soils are on flood plains. Shelocta soils are on the higher parts of some foot slopes. Also included are small areas of deep, somewhat poorly drained, gently sloping soils on concave slopes and small areas of severely eroded soils that have a silty clay loam surface layer and are on the upper part of slopes. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate above the fragipan in the Ernest soil and moderately slow or slow in the fragipan. The root zone is mainly restricted to the 20- to 36-inch zone above the fragipan. The available water capacity of this zone is low. Runoff is rapid. The subsoil is very strongly acid or strongly acid. The seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. The organic matter content is moderately low.

Most areas have been cleared of trees but are reverting to woodland. The vegetative cover is mainly pine. This soil is well suited to woodland. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

A few areas are used as cropland. This soil is moderately well suited to corn and small grain and to grasses and legumes for hay. Erosion is a severe hazard in cultivated areas. The soil can be used for cultivated crops or small grain about once in every 2 years if erosion is controlled. Growing cover crops, farming on the contour, applying a system of conservation tillage that leaves crop residue on the surface, and including grasses and legumes in the cropping sequence help to control erosion, improve tilth, and increase the organic matter content. Grassed waterways help prevent gully erosion where runoff concentrates.

A few areas are pastured. This soil is moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a moderate hazard. It can be controlled by no-till seeding or by growing a cover crop during the establishment of a newly seeded pasture. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. The soil is droughty during summer. Warm-season grasses, such as switchgrass and big bluestem, grow well on droughty soils. The forage species selected for planting should be those that have a fibrous root system, such as red clover and orchardgrass. Limited grazing during winter and other wet periods minimizes compaction.

This soil is moderately well suited to dwellings. It is better suited to dwellings without basements than to dwellings with basements. Land grading improves surface drainage. Installing drains at the base of footings helps to keep basements dry. Backfilling along foundations and footings with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. The buildings should be designed so that they conform to the natural slope of the land. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by low strength.

This soil is poorly suited to septic tank absorption fields. The slow or moderately slow permeability and the seasonal wetness are severe limitations. Using an aeration sewage disposal system helps to overcome these limitations. Enlarging the absorption field helps to overcome the restricted permeability. Installing perimeter subsurface drains around the absorption field reduces the wetness. Land grading improves surface drainage. Installing the distribution lines across the slope helps to prevent seepage of effluent to the surface.

The woodland ordination symbol is 4A. The land capability classification is IIIe. The pasture and hayland suitability group is F-3.

FoA—Fox loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on outwash terraces. Slopes are smooth and uniform. Most areas are long and narrow and are 10 to 50 acres in size.

Typically, the surface layer is brown, friable loam about 9 inches thick. The subsoil is about 20 inches of dark brown, friable clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is brown, loose very gravelly sand. In some areas the surface layer is silt loam or sandy loam. In other areas the subsoil is thinner or thicker. In places the surface layer is darker.

Included with this soil in mapping are small areas of Genesee, Huntington, and Stonelick soils on flood plains; Elkinsville soils on low stream terraces; and areas of Urban land used for building sites, parking lots, and roads. Elkinsville, Genesee, and Huntington soils have less gravel in the subsoil and substratum than the Fox soil, and Stonelick soils have less clay in the subsoil. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the subsoil of the Fox soil and rapid or very rapid in the substratum. The available water capacity is low or moderate, depending on the depth to very gravelly sand. Runoff is slow. The subsoil is strongly acid to moderately alkaline. The organic matter content is moderately low. The root zone is mainly 24 to 40 inches deep over sand and gravel.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used for cultivated crops. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. It is droughty during dry periods. Measures that increase the rate of water infiltration, conserve moisture, and maintain tilth and the organic matter content are the main management needs. Examples are no-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes.

Many areas are pastured. The soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. The soil is droughty in summer. Warm-season grasses, such as switchgrass and big bluestem, grow well on droughty soils. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone. The forage species selected for planting should be those that have a fibrous root system, such as red clover and orchardgrass.

This soil is well suited to dwellings and septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water. Installing the absorption field in suitable fill material improves the filtering capacity. Backfilling along foundations and footings with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. Replacing the surface layer and subsoil with suitable base material minimizes the damage to local roads and streets caused by frost action and by shrinking and swelling. The soil is a good source of sand and gravel.

The woodland ordination symbol is 4A. The land capability classification is IIs. The pasture and hayland suitability group is A-1.

FoB—Fox loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on glacial outwash terraces. Slopes are smooth and uniform. Most areas are long and narrow and are 5 to 25 acres in size.

Typically, the surface layer is brown, friable loam about 9 inches thick. The subsoil is about 20 inches of dark brown, friable clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is brown, loose very gravelly sand. In some areas the surface layer is silt loam or sandy loam. In other areas the subsoil is thinner. In some places the surface layer is dark. In other places, the subsoil is thicker and the substratum is below a depth of 40 inches.

Included with this soil in mapping are small areas of Genesee and Stonelick soils on flood plains and Elkinsville and Martinsville soils on low stream terraces. Elkinsville and Genesee soils have less gravel in the subsoil and substratum than the Fox soil, Martinsville soils have a thicker subsoil, and Stonelick soils have less clay in the subsoil. Also included are areas of Urban land, which are used as sites for buildings, parking lots, and roads. Inclusions make up about 15 percent of most mapped areas.

Permeability is moderate in the subsoil of the Fox soil and rapid or very rapid in the substratum. The available water capacity is low or moderate, depending on the depth to very gravelly sand. Runoff is medium. The subsoil is strongly acid to moderately alkaline. The organic matter content is moderately low. The root zone is mainly moderately deep over sand and gravel.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used for cultivated crops. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. It is droughty during dry periods and is susceptible to erosion. Measures that control erosion, conserve moisture, increase the rate of water infiltration, and maintain tilth and the organic matter content are the main management needs. Examples are no-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes.

Many areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. The soil is droughty in summer. Warm-season grasses, such as switchgrass and big bluestem, grow well on droughty soils. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone. Red clover, orchardgrass, and other forage species that have a fibrous root system should be selected for planting.

This soil is well suited to dwellings and septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water. Installing the absorption field in suitable fill material improves the filtering capacity. Backfilling along foundations with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. The droughtiness of this soil adversely affects lawns, especially during dry periods. Replacing the surface layer and subsoil with suitable base material minimizes the damage to local roads and streets caused by frost action and by shrinking and swelling. The soil is a good source of sand and gravel.

The woodland ordination symbol is 4A. The land capability classification is IIe. The pasture and hayland suitability group is A-1.

FoC—Fox loam, 6 to 12 percent slopes. This deep, strongly sloping, well drained soil is on slope breaks on outwash terraces. Slopes are smooth and uniform. Most areas are long and narrow and are 5 to 30 acres in size.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil is about 20 inches of dark brown, friable clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is brown, loose very gravelly sand. In some areas the soil is moderately steep. In a few areas the surface layer is gravelly loam or clay loam.

Included with this soil in mapping are small areas of Genesee and Stonelick soils on flood plains; small areas of severely eroded soils on the upper part of slopes; and small areas of Urban land used for building sites, parking lots, or roads. Genesee soils have less gravel in the subsoil and substratum than the Fox soil, and Stonelick soils have less clay in the subsoil. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the subsoil of the Fox soil and rapid or very rapid in the substratum. The available water capacity is low. Runoff is medium. The subsoil is strongly acid to moderately alkaline. The organic matter content is moderately low. The root zone is mainly moderately deep over sand and gravel.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used as cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. It is droughty during dry periods and is highly susceptible to erosion. Measures that control erosion, conserve moisture, increase the rate of water infiltration, and maintain tilth and the organic matter content are the main management needs. Examples are no-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes. The slope may limit the use of some equipment.

Many areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. The soil is droughty in summer. Warm-season grasses, such as switchgrass and big bluestem, grow well on droughty soils. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a moderate hazard. No-till seeding and cover crops or companion crops help to control erosion during the establishment of a newly seeded pasture. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone. The forage species selected for planting should be those that have a fibrous root system, such as red clover and orchardgrass.

This soil is well suited to dwellings. Buildings should be designed so that they conform to the natural slope of the land. Backfilling along foundations and footings with material that has a low shrink-swell potential and extending the foundations of buildings without basements to the underlying sand and gravel minimize the structural damage caused by shrinking and swelling. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Providing suitable base material minimizes the damage to local roads an streets caused by frost action and by shrinking and swelling. The droughtiness of this soil adversely affects lawns, especially during dry periods. The soil is a good source of sand and gravel.

This soil is well suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water. Installing the absorption field in suitable fill material improves the filtering capacity. Installing the distribution lines on the contour helps to prevent seepage of effluent to the surface.

The woodland ordination symbol is 4A. The land capability classification is IIIe. The pasture and hayland suitability group is A-1.

Ge—Genesee silt loam, occasionally flooded. This deep, nearly level, well drained soil is on wide, broad flood plains. Slopes are typically smooth and uniform. They are 0 to 2 percent. Most areas are long and narrow and are 40 to 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 11 inches thick. The upper part of the substratum is brown and dark yellowish brown, friable loam and silt loam. The lower part to a depth of about 60 inches is dark yellowish brown, very friable sandy loam. In some areas the surface layer is loam or sandy loam. In a few areas the soil is moderately well drained. In places it has less clay and more sand throughout.

Included with this soil in mapping are small areas of Huntington soils in the higher positions on the flood plains. These soils have a surface layer that is darker than that of the Genesee soil. Also included are small areas of the somewhat poorly drained Orrville soils in high water channels and narrow strips of strongly sloping soils along the high water channels. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Genesee soil. The available water capacity is high. Runoff is slow. The root zone is slightly acid to moderately alkaline. The organic matter content is moderately low.

A small acreage of this soil is used for timber. It is well suited to trees. No major hazards or limitations affect planting or harvesting.

Most areas are used as cropland. This soil is well suited to most row crops, such as corn and soybeans. Flooding is a hazard, but it usually occurs before row crops are planted. Some crops, such as winter wheat and hay, can be damaged by floodwater. Minimizing tillage, incorporating crop residue into the plow layer, and tilling within the optimum range of moisture content help to maintain the organic matter content and improve tilth. Leaving a cover crop or stubble on the field throughout the winter helps to control the erosion caused by floodwater.

A few areas are pastured. This soil is well suited to pasture. Meadows can be damaged by flooding and the deposition of sediment.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding. Overcoming this hazard is very costly. The soil is well suited to recreational uses, such as picnic and camp areas and hiking trails (fig. 4).

The woodland ordination symbol is 5A. The land capability classification is IIw. The pasture and hayland suitability group is A-5.

GpB—Gilpin silt loam, 3 to 8 percent slopes. This moderately deep, gently sloping, well drained soil is on ridgetops in the uplands. Slopes are smooth and uniform or are slightly convex. Most areas are long and narrow and are 5 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is strong brown, firm channery and very channery silt loam about 14 inches thick. Fine grained sandstone bedrock is at a depth of about 20 inches. In some areas the depth to bedrock is more than 40 inches. In other areas the lower part of the subsoil is mottled. In a few areas the subsoil has no coarse fragments. In a few places the soil is underlain by hard sandstone bedrock.

Included with this soil in mapping are small areas of Coolville, Rarden, and Tilsit soils. Also included are a few areas of shallow soils. Coolville and Rarden soils are in scattered areas throughout the unit. They have more clay in the subsoil than the Gilpin soil. The deep Tilsit soils are near the center of ridgetops. The shallow soils are on the higher parts of the ridgetops. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Gilpin soil. The available water capacity is low or very low. Runoff is

Figure 4.—Camping facilities in an area of Genesee silt loam, occasionally flooded.

medium. The root zone is moderately deep. It is strongly acid to extremely acid unless the soil has been limed. The organic matter content is moderately low.

Some areas are wooded. This soil is well suited to woodland. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard on the shallow included soils.

Some areas are used as cropland. This soil is moderately well suited to corn and small grain and to grasses and legumes for hay. Erosion is a moderate hazard in cultivated areas. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, and a cropping sequence that includes grasses and legumes help to control erosion and conserve moisture. Grassed waterways help to prevent gully erosion where runoff concentrates. Crusting of the surface layer after hard rains reduces the rate of water infiltration and hinders seedling emergence. Tilling within the proper range of moisture content minimizes compaction.

Some areas are pastured. This soil is moderately well suited to pasture. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species.

This soil is moderately well suited to dwellings. The bedrock at a depth of 20 to 40 inches interferes with excavations for basements and utility lines. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective wall coating minimizes the corrosion of concrete. Replacing the surface layer and subsoil with suitable base material minimizes the damage to local roads and streets caused by frost action.

This soil is poorly suited to septic tank absorption fields because of the moderate depth to bedrock. Installing the distribution lines in a mound of suitable fill material elevates the absorption field above the bedrock and improves the filtering capacity of the field. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4A. The land capability classification is IIe. The pasture and hayland suitability group is F-1.

GpC—Gilpin silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on ridgetops and shoulder slopes in the uplands. Slopes are smooth and uniform or are slightly convex. Most areas are long and narrow and are 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is strong brown, firm channery and very channery silt loam about 14 inches thick. Siltstone bedrock is at a depth of about 20 inches. In some areas the depth to bedrock is more than 40 inches. In a few areas the soil is underlain by hard sandstone. In other areas the lower part of the subsoil is mottled. In a few places the content of flat stone fragments is higher in the subsoil, and in other places it is lower.

Included with this soil in mapping are small areas of Coolville, Rarden, and Tilsit soils. Also included are a few areas of shallow soils. Coolville and Rarden soils are in scattered areas throughout the unit. They have more clay in the subsoil than the Gilpin soil. The deep Tilsit soils are on the broad, nearly level ridgetops along the edges of the unit. The shallow soils are on the higher parts of the ridgetops. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Gilpin soil. The available water capacity is low or very low. Runoff is rapid. The root zone is moderately deep. It is strongly acid to extremely acid unless the soil has been limed. The organic matter content is moderately low.

Some areas are wooded. This soil is well suited to woodland. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard on the shallow included soils.

A few areas are used as cropland. This soil is moderately well suited to corn and small grain and to grasses and legumes for hay. Erosion is a severe hazard in cultivated areas. Cultivated crops or small grain can be grown about once every 2 years if erosion is controlled and the soil is otherwise well managed. Cover crops, no-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, and contour tillage help to control erosion and conserve moisture. Grassed waterways help to prevent gully erosion where runoff concentrates. A cropping sequence that includes grasses and legumes and a mulch of crop residue increase the rate of water infiltration, minimize surface crusting, improve tilth, and increase the organic matter content. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and inhibits seedling emergence. Tilling within the proper range of moisture content minimizes compaction.

Many areas are pastured. This soil is moderately well suited to pasture. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help maintain the stand of key forage species.

This soil is moderately well suited to dwellings. The moderate depth to bedrock and the slope are limitations. Buildings should be designed so that they conform to the natural slope of the land. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective wall coating around footings minimizes the corrosion of concrete. Replacing the surface layer and subsoil with suitable base material minimizes the damage to local roads and streets caused by frost action.

This soil is poorly suited to septic tank absorption fields because of the slope and the moderate depth to bedrock. Installing the distribution lines across the slope and in a mound of suitable fill material elevates the absorption field above the bedrock, improves the filtering capacity, and helps to prevent seepage of effluent to the surface. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4A. The land capability classification is IIIe. The pasture and hayland suitability group is F-1.

GpD—Gilpin silt loam, 15 to 25 percent slopes. This moderately deep, moderately steep, well drained soil is on side slopes in the uplands. Most areas have smooth or convex slopes. They are long and narrow and are 5 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is strong brown, firm channery and very channery silt loam about 14 inches thick. Siltstone bedrock is at a depth of about 20 inches. In some areas the depth to bedrock is more than 40 inches. In a few areas the bedrock is hard sandstone. In places the lower part of the subsoil is mottled. In a few places the subsoil has a higher content of flat stone fragments.

Included with this soil in mapping are small areas of Brownsville, Coolville, and Rarden soils. Also included are a few areas of shallow soils. The deep Brownsville soils and the shallow soils have a higher content of coarse fragments throughout than the Gilpin soil. They are on shoulder slopes and the higher parts of ridges. Coolville and Rarden soils have more clay in the subsoil than the Gilpin soil. Coolville soils are on the less sloping parts of ridgetops. Rarden soils are in scattered areas throughout the unit. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Gilpin soil. The available water capacity is low or very low. Runoff is rapid. Unless the soil is limed, the root zone is extremely acid to strongly acid. It is moderately deep. The organic matter content is moderately low.

Most areas are wooded. This soil is well suited to woodland. Building skid trails and logging roads on the contour facilitates the use of equipment and minimizes erosion. Water bars or other measures that control runoff and erosion are needed. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south aspects. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard on the shallow included soils. Leaving adequately wide areas of unharvested trees along all streams in the harvest area minimizes the sedimentation of streams. The slope limits the use of wheeled planting and logging equipment. Tracked equipment can be used. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil, but caution is needed.

A few areas are used as cropland. This soil is poorly suited to corn and small grain and to grasses and legumes for hay. Erosion is a severe hazard in cultivated areas. Cultivated crops can be grown occasionally if erosion is controlled and the soil is otherwise well managed. A commonly used crop rotation includes cultivated crops once every 4 years. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, contour stripcropping, a cropping sequence that includes grasses and legumes, cover crops, grassed waterways, and incorporation of crop residue into the plow layer help to control erosion, improve tilth, and increase the organic matter content.

Some areas are pastured. This soil is moderately well suited or poorly suited to pasture. If the pasture is plowed during seedbed preparation or overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. The slope limits the use of some wheeled planting and mowing equipment. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone.

This soil is poorly suited to dwellings and is generally unsuitable as a site for septic absorption fields because of the slope and the bedrock at a depth of 20 to 40 inches. Land shaping is needed in many areas. The bedrock is rippable in most areas. Buildings should be designed so that they conform to the natural slope of the land. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Local roads should be built across the slope. Septic tank absorption fields can be installed on the better suited nearby soils.

The woodland ordination symbol is 4R. The land capability classification is IVe. The pasture and hayland suitability group is F-1.

Ha—Haymond silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Slopes are smooth and even. They are 0 to 2 percent. Most areas are irregularly shaped and are 20 to 180 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The upper part of the substratum is brown, friable silt loam. The lower part to a depth of about 72 inches is yellowish brown and brown, friable silt loam and loam. The substratum is mottled between depths of 32 and 58 inches. In some areas the subsoil has more clay or more sand. In a few areas a compact, dense zone is below a depth of 60 inches. In some places the soil is strongly acid throughout. In other places it is moderately well drained.

Included with this soil in mapping are small areas of the somewhat poorly drained Stendal soils in slight depressions, in abandoned stream channels, and in narrow bands adjacent to slope breaks to terraces and uplands. Also included are small areas of Clifty and Skidmore Variant soils on alluvial fans where very small drainageways enter the wider valleys and many small areas of Elkinsville soils on slightly elevated knobs on the flood plains. Clifty and Skidmore Variant soils have a higher content of coarse fragments in the subsoil than the Haymond soil. Elkinsville soils have more clay in the upper part than the Haymond soil. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Haymond soil. The available water capacity is very high. Runoff is slow. The potential for frost action is high. The root zone is medium acid to neutral. It is deep. The organic matter content is moderate. The surface layer crusts after heavy rainfall.

A few irregularly shaped areas along meandering streams are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Most areas are used as cropland. Many are narrow, and some are cut into irregularly shaped tracts by meandering streams. This soil is well suited to most row crops, such as corn and soybeans. Flooding is a hazard, but it usually occurs in winter and spring, before row crops are planted. Such crops as winter wheat and hay can be damaged by floodwater. Crusting of the surface layer reduces the rate of water infiltration and hinders seedling emergence. Minimizing tillage, incorporating crop residue into the plow layer, and tilling within the optimum range of moisture content help to maintain soil structure, minimize compaction and crusting, increase the infiltration rate, and improve tilth. Leaving a cover crop or stubble in the field throughout the winter helps to control the erosion caused by floodwater. Scattered subsurface drains are needed in the wetter included soils.

Some areas are pastured. This soil is well suited to pasture. Meadows can be damaged by floodwater and the deposition of sediment. Proper stocking rates, rotation grazing, and weed control help to maintain the desirable pasture species. Limited grazing during wet periods helps to prevent compaction.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding. Overcoming this hazard is very costly.

The woodland ordination symbol is 5A. The land capability classification is IIw. The pasture and hayland suitability group is A-5.

Hu—Huntington silt loam, occasionally flooded. This deep, nearly level, well drained soil is on broad flood plains. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 40 to 200 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 13 inches thick. The subsoil is dark yellowish brown, friable and very friable silt loam about 28 inches thick. The upper part of the substratum is brown, very friable loam. The lower part to a depth of about 65 inches is dark yellowish brown, loose loamy sand. In some areas the surface layer and subsurface layer are thinner. In other areas the subsoil has more sand. In places the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Genesee and Stonelick soils. These soils have a surface layer that is lighter colored than that of the Huntington soil. Genesee soils are in the lower positions on the flood plains. Stonelick soils are on slope breaks and along drainageways. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Huntington soil. The available water capacity is high. Runoff is slow. The root zone is deep and is medium acid to mildly alkaline. The potential for frost action is high. The organic matter content is moderate.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used as cropland. This soil is well suited to most row crops, such as corn and soybeans, and to small grain. Flooding is the main hazard, but it usually occurs in late winter and early spring, before row crops are planted. Winter wheat and hay can be damaged by flooding and by the deposition of sediment. Minimizing tillage, incorporating crop residue into the plow layer, and tilling within the optimum range of moisture content help to maintain the organic matter content and improve tilth. Controlling Johnsongrass is difficult in most areas. Herbicides are commonly used.

A few areas are pastured. This soil is well suited to grasses and legumes for pasture. Floodwater and siltation can limit grazing and damage plants. Also, frost action can damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding.

The woodland ordination symbol is 5A. The land capability classification is IIw. The pasture and hayland suitability group is A-5.

LaC—Latham silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, moderately well drained soil is generally on dissected ridgetops and toe slopes in the uplands. A few areas are on side slopes. Slopes are typically uneven and are dissected by small drainageways. Most areas are irregularly shaped and are 10 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is strong brown and yellowish brown, mottled, firm silty clay loam, and the lower part is pale brown and strong brown, mottled, very firm silty clay loam and silty clay. Light gray, weathered, soft shale bedrock is at a depth of about 36 inches. In some areas the subsoil has less clay. In other areas the soil is well drained. In places it is deep over bedrock.

Included with this soil in mapping are small areas of Bratton and Opequon soils on the edges of ridgetops and on shoulder slopes. Bratton soils are moderately deep and Opequon soils shallow over dolomitic limestone bedrock. Also included, on the higher parts of ridgetops, are small areas of soils that are shallow over soft, black shale bedrock. Small areas of deep, well drained Shelocta soils are on foot slopes. Included soils make up about 10 percent of most mapped areas.

Permeability is slow in the Latham soil, and the available water capacity is low. Runoff is rapid. The root zone is moderately deep. The subsoil is very strongly acid or extremely acid. The organic matter content is moderately low. A seasonal high water table is at a depth of 18 to 36 inches during wet periods. The potential for frost action and the shrink-swell potential are high.

Most areas have been cleared of trees but are reverting to woodland. The vegetative cover in most areas is native tree species, mostly cedar and pine. This soil is moderately well suited to woodland. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Planting seedlings that have been transplanted once reduces the seedling mortality rate.

Some areas are used as cropland. This soil is moderately well suited to corn and small grain and to grasses and legumes for hay. Cultivated crops or small grain can be grown about once every 2 years if conservation measures are applied. Erosion is a severe hazard in cultivated areas. Cover crops, no-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, and contour tillage help to control erosion, improve tilth, and increase the organic matter content. Grassed waterways help to prevent gully erosion where runoff concentrates. Including grasses and legumes in the cropping sequence and mulching with crop residue help to maintain tilth and the organic matter content.

A few areas are pastured. The soil is moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes soil compaction. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone and the high potential for frost action. Forage species that have a fibrous root system grow well.

This soil is moderately well suited to dwellings. Because of the depth to bedrock and the seasonal high water table, it is better suited to dwellings without basements than to dwellings with basements. Buildings should be designed so that they conform to the natural slope of the land. Reinforcing foundations and footings minimizes the structural damage caused by shrinking and swelling. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by low strength and frost action. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective coating around footings minimize the corrosion of concrete. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion.

This soil is poorly suited to septic tank absorption fields because of the slow permeability, the seasonal wetness, and the depth to bedrock. Installing the distribution lines in a mound of suitable fill material increases the depth to bedrock. Enlarging the absorption field helps to overcome the restricted permeability. Installing perimeter drains around the absorption field reduce the wetness. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 3C. The land capability classification is IVe. The pasture and hayland suitability group is F-1.

LdD—Latham-Wharton silt loams, 15 to 25 percent slopes. These moderately steep, moderately well drained soils are on hillsides in the uplands. The Latham soil is moderately deep, and the Wharton soil is deep. Most areas are about 45 percent Latham soil and 35 percent Wharton soil. On any given slope, however, either soil may be dominant. In some areas seeps and hillside slippage are common. Slopes are commonly even, but some are dissected by small drainageways. Most areas are long and narrow and are 25 to 250 acres in size. Because the two soils occur as alternating narrow bands at different elevations, it is not practical to separate them in mapping.

Typically, the Latham soil has partially decomposed leaf litter at the surface. The surface layer is dark grayish brown, very friable silt loam about 2 inches thick. The subsurface layer is yellowish brown, firm silt loam about 6 inches thick. The subsoil is about 26 inches thick. The upper part is reddish yellow, firm silty clay loam, and the lower part is strong brown and light olive brown, mottled, firm and very firm silty clay and channery silty clay. Soft, weathered, light olive brown, light brownish gray, and yellowish brown siltstone and shale bedrock is at a depth of about 34 inches. In some areas the subsoil has less clay. In many places it is redder. In a few areas the soil is deep.

Typically, the Wharton soil has a surface layer of brown, friable silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown and strong brown, firm silt loam and channery silty clay loam, and the lower part is yellowish brown and light olive brown, mottled, very firm channery silty clay loam and silty clay. The substratum to a depth of about 66 inches is light olive brown, mottled, very firm silty clay. In some areas the soil is well drained. In other areas it is underlain by hard sandstone bedrock.

Included with these soils in mapping are small areas of shallow soils and the deep Brownsville, Clifty, and Tilsit soils. Clifty soils are on flood plains. The shallow soils and the Brownsville soils are on the upper parts of hillsides and on slope breaks. Tilsit soils are on ridgetops. Included soils make up about 20 percent of most mapped areas.

Permeability is slow in the Latham soil and moderately slow or slow in the Wharton soil. The available water capacity is moderate in the Wharton soil and low in the Latham soil. Runoff is very rapid in cultivated areas of both soils. The potential for frost action is high. Unless lime has been applied, the root zone is extremely acid to strongly acid in the Wharton soil and extremely acid or very strongly acid in the Latham soil. Both soils have a seasonal high water table at a depth of 18 to 36 inches during wet periods. The organic matter content is moderately low. The Latham soil has a high shrink-swell potential.

Most areas are wooded. These soils are moderately well suited to woodland. The Wharton soil is better suited than the Latham soil. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south aspects. Building logging roads and skid trails on the contour facilitates the use of equipment and minimizes erosion. Water bars or other measures that reduce runoff and erosion are needed. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard. Plant competition on the Wharton soil can be controlled by removing vines and the less desirable trees and shrubs. The slope limits the use of some wheeled planting and logging equipment. Tracked equipment can be used. The equipment used in mechanical tree planting and in mowing for weed control can be operated on these soils, but caution is needed. The species selected for planting on the Latham soil should be those that are tolerant of a high content of clay.

A few areas are used as cropland. Because of a severe erosion hazard and the slope, these soils are generally unsuited to row crops and small grain and to grasses and legumes for hay.

Some areas are pastured. These soils are moderately well suited or poorly suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding methods in which the seeds are planted on the contour and by companion crops. Proper stocking rates, pasture rotation, weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction. The slope limits the use of some wheeled equipment. Maintaining stands of deep-rooted legumes is difficult because of frost action and the acid root zone. Forage species that have a fibrous root system grow well.

These soils are generally unsuitable as sites for dwellings and septic tank absorption fields because of the slope, seasonal wetness, restricted permeability of both soils, and the hazard of hillside slippage, high shrink-swell potential, and limited depth to bedrock in areas of the Latham soil.

The woodland ordination symbol assigned to the Latham soil is 4R on north aspects, 3R on south aspects, and the one assigned to the Wharton soil is 4R on north and south aspects. The land capability classification is VIe. The pasture and hayland suitability group is F-1 for the Latham soil and A-2 for the Wharton soil.

MaB2—Markland silty clay loam, 3 to 8 percent slopes, eroded. This deep, gently sloping, moderately well drained and well drained soil is on lacustrine terraces. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are irregularly shaped and are 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, firm silty clay loam about 9 inches thick. The subsoil is yellowish brown, firm and very firm silty clay about 24 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous, very firm silty clay and silty clay loam. In some areas the surface layer is silt loam. In other areas the soil is mottled directly below the surface layer. In a few areas the subsoil has less clay.

Included with this soil in mapping are small areas of Otwell, McGary, Montgomery Variant, and Negley soils. Otwell soils have a fragipan. They are on broad outwash terraces. The somewhat poorly drained McGary and very poorly drained Montgomery Variant soils are in depressions and along drainageways. Negley soils have more sand in the subsoil than the Markland soil. They are on side slopes. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Markland soil. The available water capacity is moderate. Runoff is medium. The shrink-swell potential is high. The root zone is medium acid to moderately alkaline. It generally is moderately deep to compact, calcareous lakebed sediments. The organic matter content is moderately low. The seasonal high water table is at a depth of 36 to 72 inches during wet periods.

A few areas are wooded. This soil is moderately well suited to woodland. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

A few areas are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Cultivated crops and small grain can be grown year after year if erosion is controlled and improved management is applied. The erosion hazard is moderate in cultivated areas. Including grasses and legumes in the cropping sequence and incorporating crop residue into the plow layer help to maintain tilth and the organic matter content. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, contour farming, and cover crops help to control erosion. Grassed waterways help to prevent gully erosion in areas where runoff concentrates. The soil should be tilled within a limited range of moisture content because it becomes compact and cloddy if it is worked when wet and sticky.

Most areas are pastured (fig. 5). This soil is moderately well suited to pasture. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone. Forage species that have a fibrous root system grow well. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction.

This soil is moderately well suited to dwellings. The high shrink-swell potential is a limitation. Reinforcing foundations and footings minimizes the structural damage caused by shrinking and swelling. Backfilling the excavations around walls and foundations with material that has a low shrink-swell potential also minimizes this damage. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by shrinking and swelling and by low strength.

This soil is poorly suited to septic tank absorption fields because of the slow permeability and the seasonal wetness. Enlarging the absorption field helps to overcome the slow permeability. Perimeter subsurface drains lower the water table. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4C. The land capability classification is IIIe. The pasture and hayland suitability group is F-5.

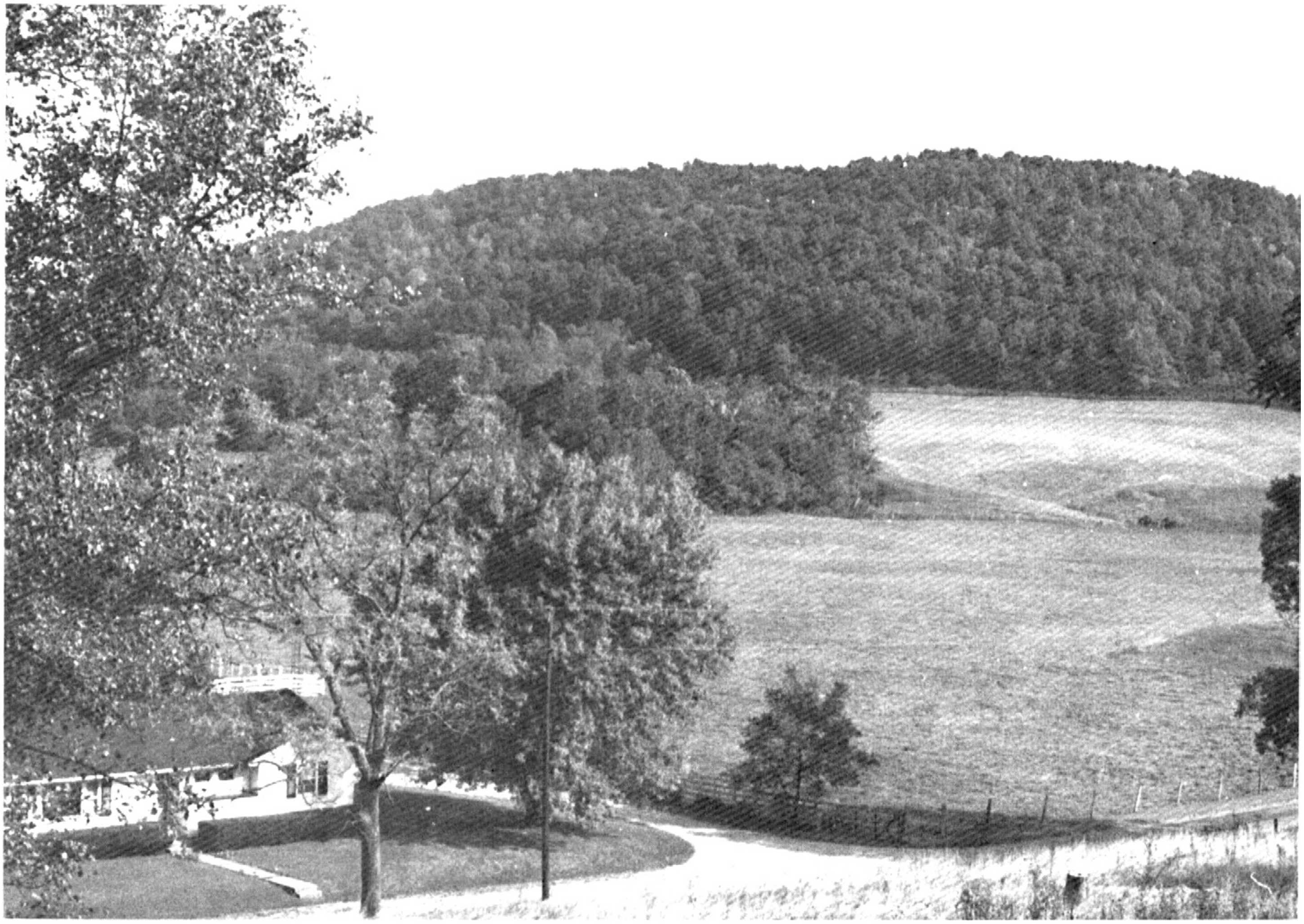

Figure 5.—A pastured area of Markland silty clay loam, 3 to 8 percent slopes, eroded. Shelocta and Brownsville soils are on the hillsides in the background.

MaC2—Markland silty clay loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained and well drained soil is on dissected parts of lacustrine terraces. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are irregularly shaped and are 5 to 30 acres in size.

Typically, the surface layer is brown, firm silty clay loam about 7 inches thick. The subsoil is yellowish brown, firm and very firm silty clay about 21 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is yellowish brown, calcareous, very firm silty clay and silty clay loam. In some areas the surface layer is silt loam. In other areas the subsoil has more sand and silt.

Included with this soil in mapping are small areas of Otwell, McGary, Montgomery Variant, and Negley soils. Otwell soils have a fragipan. They are in the less sloping areas. The somewhat poorly drained McGary soils are along drainageways. The very poorly drained Montgomery Variant soils are on flood plains. Negley soils have more sand and gravel in the subsoil than the Markland soil. They are in scattered areas throughout the unit. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Markland soil. The available water capacity is moderate. Runoff is rapid.

The shrink-swell potential is high. The root zone is medium acid to moderately alkaline. The organic matter content is moderately low. The seasonal high water table is at a depth of 36 to 72 inches during wet periods.

A few areas are wooded. This soil is moderately well suited to woodland. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting techniques that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

A few areas are used as cropland. This soil is poorly suited to corn, soybeans, and small grain. Erosion is a severe hazard in cultivated areas. Cultivated crops or small grain can be grown about once every 2 years if conservation practices and improved management are applied. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, contour tillage, and cover crops help to control erosion. Grassed waterways help to prevent gully erosion where runoff concentrates. Including grasses and legumes in the cropping sequence and incorporating crop residue into the plow layer help to maintain tilth and the organic matter content. The soil should be tilled within a limited range of moisture content because it becomes compact and cloddy if it is worked when wet and sticky.

Most areas are pastured. This soil is moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone. Forage species that have a fibrous root system grow well. Limited grazing during winter and other wet periods minimizes soil compaction.

Some areas are used as sites for buildings. This soil is moderately well suited to dwellings. The high shrink-swell potential is a limitation. Reinforcing foundations and footings minimizes the structural damage caused by shrinking and swelling. Backfilling the excavations around walls and foundations with material that has a low shrink-swell potential also minimizes this damage. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by shrinking and swelling and by low strength.

This soil is poorly suited to septic tank absorption fields because of the slow permeability, the slope, and the seasonal wetness. Enlarging the absorption field helps to overcome the slow permeability. Installing perimeter subsurface drains helps to lower the water table. Installing the distribution lines on the contour helps to prevent seepage of effluent to the surface. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4C. The land capability classification is IVe. The pasture and hayland suitability group is F-5.

MaD2—Markland silty clay loam, 15 to 25 percent slopes, eroded. This deep, moderately steep, moderately well drained and well drained soil is on hillsides along drainageways on the dissected parts of lacustrine terraces. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are irregularly shaped and are 5 to 20 acres in size.

Typically, the surface layer is brown, firm silty clay loam about 6 inches thick. The subsoil is yellowish brown, firm and very firm silty clay about 19 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is yellowish brown, calcareous, very firm silty clay and silty clay loam. In some areas the surface layer is silt loam. In other areas the subsoil has more sand and silt.

Included with this soil in mapping are small areas of Negley soils. These soils have more sand and less clay in the subsoil than the Markland soil. They are in scattered areas throughout the unit. They make up about 10 percent of most mapped areas.

Permeability is slow in the Markland soil. The available water capacity is moderate. Runoff is very rapid. The shrink-swell potential is high. The root zone is medium acid to moderately alkaline. It is generally moderately deep to compact, calcareous lakebed sediments. The organic matter content is moderately low. The seasonal high water table is at a depth of 36 to 72 inches during wet periods.

Some areas are wooded. This soil is moderately well suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building skid trails and logging roads on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars on logging roads and skid trails reduce the hazard of erosion during and after harvest. Leaving strips of unharvested trees along streams helps to control sedimentation. The slope limits the use of some wheeled planting and logging equipment. Tracked equipment can be used. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Harvesting techniques that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

A few areas are used as cropland. Because of a severe erosion hazard and the slope, this soil is generally unsuited to corn, soybeans, and small grain and to grasses and legumes for hay.

Most areas are pastured. This soil is moderately well suited or poorly suited to pasture. Erosion is a severe hazard if the pasture is plowed during seedbed preparation or is overgrazed. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone. Forage species that have a fibrous root system grow well. Limited grazing during winter and other wet periods minimizes compaction. The use of some wheeled equipment is limited on these short, moderately steep slopes.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the slope, the slow permeability, the seasonal wetness, and the high shrink-swell potential.

The woodland ordination symbol is 4R. The land capability classification is VIe. The pasture and hayland suitability group is F-5.

Mh—Martinsville loam, rarely flooded. This deep, nearly level, well drained soil is on low stream terraces. It is flooded during periods of unusually high runoff. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 20 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsurface layer is brown, friable loam about 3 inches thick. The subsoil is about 31 inches thick. It is strong brown, friable loam, clay loam, and sandy loam. The substratum to a depth of about 70 inches is dark yellowish brown and yellowish brown, stratified, loose loamy sand, sand, and sandy loam. In some areas the surface layer is silt loam. In places it is very dark brown.

Included with this soil in mapping are small areas of Fox soils on slope breaks, small areas of Elkinsville soils, and moderately steep areas along drainageways and near the edges of the unit. Fox soils have more sand and gravel at a depth of 24 to 40 inches than the Martinsville soil. Elkinsville soils have more silt and less sand in the subsoil than the Martinsville soil. Also included are narrow strips of Genesee, Huntington, and Stonelick soils on flood plains. These soils irregularly decrease in organic matter content with increasing depth. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the Martinsville soil. The available water capacity is high. Runoff is slow. The root zone is medium acid or slightly acid. The organic matter content is moderate.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used as cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. The erosion hazard is slight in cultivated areas. Maintaining tilth and the organic matter content is the major management concern. A system of conservation tillage that leaves crop residue on the surface most of the year, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes help to maintain tilth and the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

A few areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding. Building dikes and flood walls is costly. The soil is well suited to recreational uses, such as picnic areas, hiking trails, and golf fairways. Flooding is a hazard, but it occurs mainly during periods when these recreational areas are not used.

The woodland ordination symbol is 5A. The land capability classification is I. The pasture and hayland suitability group is A-1.

MkA—McGary silt loam, 0 to 4 percent slopes. This deep, nearly level and gently sloping, somewhat poorly drained soil is on slight rises on lacustrine terraces and in preglacial valleys. Slopes are typically smooth and uniform. Most areas are irregularly shaped and are 10 to 40 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 8 inches thick. The subsoil is about 32 inches thick. It is light olive brown, grayish brown, gray, and olive gray, mottled, firm silty clay and clay. The substratum to a depth of about 60 inches is multicolored, calcareous, firm and very firm silty clay loam. In some areas, the subsoil is dominantly gray and the soil is poorly drained.

Included with this soil in mapping are small areas of Markland, Otwell, and Negley soils. The moderately well drained and well drained Markland soils are on low knolls and slightly elevated knobs. Otwell soils are in the slightly higher landscape positions. They have a fragipan. The well drained Negley soils are on slope breaks. They have more sand in the subsoil than the McGary soil. Included soils make up about 15 percent of most mapped areas.

Permeability is slow or very slow in the McGary soil. The available water capacity is moderate. Runoff is slow. The subsoil is strongly acid to mildly alkaline. The shrink-swell potential is high. A seasonal high water table is at a depth of 12 to 36 inches during extended wet periods. The organic matter content is moderately low.

A few areas are wooded. This soil is moderately well suited to woodland. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Planting techniques that maximize the soil-root contact reduce the seedling mortality rate.

Some areas of this soil are used as cropland. Drained areas are moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay, but undrained areas are poorly suited. Maintaining stands of deep-rooted legumes is difficult because of a seasonal high water table. Planting is often delayed because this soil dries out slowly in the spring. Surface and subsurface drains lower the seasonal high water table. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Minimizing tillage, incorporating crop residue into the plow layer, and including grasses and legumes in the cropping sequence help to maintain tilth, increase the rate of water infiltration and the organic matter content, and minimize surface crusting. Tilling within the proper range of moisture content minimizes compaction.

Most areas are pastured. This soil is moderately well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction.

This soil is poorly suited to dwellings. Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Properly landscaping building sites helps to divert surface water away from foundations. Ditches and subsurface drains reduce the wetness. Backfilling the excavations around foundations and footings with material that has a low shrink-swell potential minimizes the damage caused by shrinking and swelling. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by shrinking and swelling and by low strength.

This soil is poorly suited to septic tank absorption fields because of the very slow or slow permeability and the seasonal wetness. Enlarging the size of the absorption field improves the ability of the soil to absorb effluent. Perimeter subsurface drains around the absorption field reduce the wetness. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4C. The land capability classification is IIIw. The pasture and hayland suitability group is C-2.

Mn—Melvin silt loam, occasionally flooded. This deep, nearly level, poorly drained soil is on flood plains. Slopes are 0 to 2 percent. Most areas are long and narrow and are 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 80 inches is light brownish gray and light gray, mottled, firm silt loam and loam. In a few areas the soil has more clay in the upper part, and in some areas it has less clay.

Included with this soil in mapping are small areas of the moderately well drained Wilbur and somewhat poorly drained Stendal soils on the slightly higher parts of the flood plains. Also included are small areas of the moderately well drained Omulga and Wyatt soils on side slopes in preglacial valleys. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the Melvin soil. The available water capacity is very high. Runoff is very slow. The organic matter content is moderate. The root zone is medium acid to very strongly acid. The seasonal high water table is near the surface during extended wet periods.

This soil is moderately well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Special site preparation, such as bedding or another kind of surface drainage system, reduces the seedling mortality rate. The trees selected for planting should be those that can grow well on a poorly drained soil that is subject to flooding. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard. Harvesting or planting when the soil is dry or frozen minimizes compaction and facilitates the use of equipment.

Except for a few scattered woodlots, most areas have been cleared of trees and are used for corn or soybeans. Drained areas are well suited to cropland, but undrained areas are poorly suited. Planting is often delayed because this soil dries out slowly in the spring. Surface and subsurface drains can lower the seasonal high water table, but locating drainage outlets commonly is difficult. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Planting cover crops, minimizing tillage, and incorporating crop residue into the plow layer help to maintain tilth, increase the infiltration rate, minimize surface crusting, and protect the surface layer in areas that are subject to scouring by floodwater.

A few areas are pastured. Drained areas are well suited to pasture, but undrained areas are poorly suited. Meadows can be damaged by flooding and the deposition of sediment. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction. The seasonal wetness limits the use of equipment.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding and the seasonal wetness.

The woodland ordination symbol is 6W. The land capability classification is IIIw. The pasture and hayland suitability group is C-3.

MoD—Miami Variant silt loam, 15 to 30 percent slopes. This deep, moderately steep, well drained soil is on glaciated hillsides in the uplands. Slopes generally are smooth and convex. A few large boulders are on the surface. Most areas are long and narrow and are 20 to 50 acres in size.

Typically, partially decomposed leaf litter is at the surface. The surface layer is very dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 37 inches thick. It is yellowish brown and strong brown, firm silty clay loam in the upper part and yellowish brown, mottled, firm silty clay loam and silty clay in the lower part. Soft shale bedrock is at a depth of about 42 inches. In a few places the upper part of the soil did not form in glacial till. In some areas the soil is steep.

Included with this soil in mapping are small areas of Miamian, Shelocta, and Trappist soils and some areas of severely eroded soils that have a surface layer of silty clay loam and are on slope breaks. Miamian soils are on the lower part of the slopes. They have till pebbles throughout. Shelocta and Trappist soils are in the higher landscape positions. They do not have till pebbles in the upper part. Also included, along drainageways, are a few small areas of soils that are shallow over bedrock. Included soils make up about 10 percent of most mapped areas.

Permeability is slow in the Miami Variant soil. The available water capacity is moderate. Runoff is rapid. The organic matter content is moderately low. A seasonal high water table is at a depth of 24 to 36 inches during extended wet periods. The subsoil ranges from very strongly acid to neutral. The potential for frost action is high.

Most areas are wooded. This soil is moderately well suited to woodland. North- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building skid trails and logging roads on or nearly on the contour helps to control runoff and erosion and facilitates the use of equipment. Water bars help to control erosion on the logging roads and skid trails. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south-facing slopes. The slope limits the use of wheeled planting equipment and some wheeled logging equipment. Tracked equipment can be used. The equipment used in mechanical planting and in mowing for weed control can be operated on this soil, but caution is needed.

Very few areas are used as cropland. Because of a severe erosion hazard and the moderately steep slope, this soil is generally unsuited to corn, to small grain, and to grasses and legumes for hay.

A few areas are pastured. This soil is poorly suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving. The slope limits the use of some wheeled equipment.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the seasonal wetness, the slope, and the slow permeability.

The woodland ordination symbol is 4R. The land capability classification is Vle. The pasture and hayland suitability group is A-2.

MpD3—Miamian clay loam, 15 to 25 percent slopes, severely eroded. This deep, moderately steep, well drained soil is on glaciated foot slopes in the uplands. Erosion has removed most of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Slopes are generally uneven and convex. They are characterized by sharp breaks and are dissected by minor drainageways. Most areas are irregularly shaped and are 5 to 40 acres in size.

Typically, the surface layer is brown, friable clay loam about 5 inches thick. The subsoil is yellowish brown and brown, firm and very firm clay loam about 31 inches thick. The substratum to a depth of about 60 inches is yellowish brown, very firm, calcareous clay loam glacial till. In some areas the subsoil has more sand and gravel.

Included with this soil in mapping are small areas of Miami Variant and Negley soils and areas of soils that have a surface layer of silt loam and are not so eroded as the Miamian soil. Miami Variant soils are 40 to 70 inches deep over shale bedrock. Negley soils are on outwash terraces. They have a subsoil that is thicker than that of the Miamian soil. Also included, on complex slopes at the higher elevations, are a few areas of soils that are underlain by sand and gravel. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Miamian soil. The available water capacity is moderate. Runoff is very rapid. The subsoil is medium acid to neutral in the upper part and neutral or mildly alkaline in the lower part. The organic matter content is low.

Most areas have been cleared of trees but are reverting to woodland. This soil is well suited to trees. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Building skid trails and logging roads on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars and other measures that control runoff and erosion are needed. The slope limits the use of wheeled planting, mowing, and spraying equipment and some wheeled logging equipment. Tracked equipment can be used.

Very few areas are used as cropland. Because of a severe erosion hazard and moderately steep slope, this soil is generally unsuited to corn and small grain and to grasses and legumes for hay.

A few areas are pastured. This soil is poorly suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, weed control, and timely application of lime and fertilizer help to control erosion and maintain the stand of key forage species. Maintaining stands of deep-rooted legumes is difficult because of the compact glacial till at a depth of 20 to 40 inches. Forage species that have a fibrous root system grow well.

This soil is poorly suited to dwellings and septic tank absorption fields because of the slope and the moderately slow permeability. Land shaping is needed in most areas. If the building site is developed by cutting and filling, a retaining wall is needed to prevent the downslope movement of the soil. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Installing septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Enlarging the field helps to overcome the restricted permeability.

The woodland ordination symbol is 5R. The land capability classification is Vle. The pasture and hayland suitability group is A-2.

Mr—Montgomery Variant silt loam, frequently flooded. This deep, nearly level, very poorly drained soil is in depressions on flood plains that transect glaciolacustrine and outwash terraces. The soil is flooded during periods of heavy rainfall. Slopes are smooth and concave and are 0 to 2 percent. Most areas are long and narrow and are 20 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsurface layer is brown, mottled, friable silt loam about 4 inches thick. Below this to a depth of about 71 inches are four layers. In sequence downward, these layers are brown, mottled, friable silty clay loam; a buried surface layer of very dark gray, firm silty clay loam; very dark gray, mottled firm silty clay loam; and multicolored, firm silty clay loam. In some areas the surface layer is darker. In a few areas it is loam or silty clay loam. In places the alluvium is deeper over the buried soil.

Included with this soil in mapping are small areas of Markland, McGary, and Otwell soils. The moderately well drained and well drained Markland soils are on the higher, dissected parts of glacial terraces. The somewhat poorly drained McGary and moderately well drained Otwell soils are higher on the landscape than the Montgomery Variant soil. Included soils make up about 10 percent of most mapped areas.

Permeability is slow or very slow in the Montgomery Variant soil. The available water capacity is high. Runoff is slow. If the soil is drained, the root zone is deep. It is slightly acid to mildly alkaline. The potential for frost action is high. The seasonal high water table is near the surface during extended wet periods. The organic matter content is moderate.

This soil is moderately well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Weeds can be controlled by spraying or mowing. The species selected for planting should be those that grow well on wet soils. Special site preparation, such as bedding or another type of surface drainage system, reduces the seedling mortality rate. Planting seedlings that have been transplanted once also reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Planting or logging during dry periods minimizes compaction and facilitates the use of equipment.

Most areas have been cleared of trees. Some are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Maintaining stands of deep-rooted legumes is difficult because of the high potential for frost action and the seasonal high water table. Reducing wetness and maintaining tilth and the organic matter content are the major management concerns. Planting and harvesting are often delayed because the soil dries out slowly. Subsurface drainage systems can lower the seasonal high water table in most areas where outlets are available. Minimizing tillage, incorporating crop residue into the plow layer, and including grasses and legumes in the cropping sequence improve tilth and increase the organic matter content. Tilling within the proper range of moisture content minimizes compaction. Fall tillage is less likely to result in surface compaction than spring tillage because the subsoil is usually drier in the fall.

Many areas are pastured. This soil is moderately well suited to pasture. Meadows can be damaged by flooding and the deposition of sediment. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction. The seasonal wetness limits the use of equipment.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the flooding, the seasonal wetness, and the slow or very slow permeability.

The woodland ordination symbol is 5W. The land capability classification is IIIw. The pasture and hayland suitability group is C-3.

NgC—Negley loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on knolls in areas of Illinoian outwash terraces. Slopes are typically smooth and uniform. Most areas are irregularly shaped and are 5 to 15 acres in size.

Typically, the surface layer is brown, friable loam about 8 inches thick. The upper part of the subsoil is yellowish red, firm loam and clay loam; the next part is strong brown, firm gravelly clay loam; and the lower part to a depth of about 80 inches is strong brown and yellowish red, firm gravelly clay loam. In some areas the surface layer is silt loam. In a few areas the soil is gently sloping.

Included with this soil in mapping are small areas of Markland, Otwell, Parke, and Taggart soils. Markland soils occur in a random pattern throughout most areas. They have more clay in the subsoil than the Negley soil. Otwell, Parke, and Taggart soils are in the less sloping areas. Otwell soils are moderately well drained. They have a fragipan. Parke and Taggart soils have more silt in the upper part of the subsoil than the Negley soil. Taggart soils are somewhat poorly drained. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate or moderately rapid in the Negley soil. The available water capacity is moderate. Runoff is rapid. The root zone is very strongly acid to slightly acid. The organic matter content is moderately low.

A few areas are wooded. This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Some areas are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Cultivated crops can be grown about once every 2 years if erosion is controlled and the soil is otherwise well managed. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, grassed waterways, and a cropping sequence that includes grasses and legumes help to control erosion and improve tilth. The soil is well suited to no-till planting.

Most areas are pastured. This soil is moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a moderate hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. The slope can limit the use of some equipment.

This soil is moderately well suited to dwellings and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Driveways should be built across the slope. Providing suitable base material minimizes the damage to local roads and streets caused by frost action. Maintaining a cover of vegetation or mulch on the site during construction helps to control runoff and erosion. The slope is a moderate limitation on sites for septic tank absorption fields. Installing the distribution lines on the contour helps to prevent seepage of effluent to the surface.

The woodland ordination symbol is 5A. The land capability classification is IIIe. The pasture and hayland suitability group is A-1.

NgD—Negley loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on side slopes and at the head of drainageways on Illinoian outwash terraces. Slopes are typically uneven and benched. Most areas are long and narrow and are 20 to 60 acres in size.

Typically, the surface layer is very dark grayish brown and brown, friable loam about 6 inches thick. The upper part of the subsoil is yellowish red, firm loam and gravelly clay loam; the next part is strong brown and dark brown, firm gravelly clay loam and gravelly loam; and the lower part to a depth of about 80 inches is strong brown and yellowish red, firm gravelly clay loam. In some areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Markland soils on foot slopes and benches. These soils have more clay in the subsoil than the Negley soil. They make up about 15 percent of most mapped areas.

Permeability is moderate or moderately rapid in the Negley soil. The available water capacity is moderate. Runoff is rapid. The root zone is very strongly acid to slightly acid. The organic matter content is moderately low.

Some areas are wooded. This soil is well suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building skid trails and logging roads on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars or other measures that control runoff and erosion are needed. The slope limits the use of wheeled planting, mowing, and spraying equipment and some wheeled logging equipment. Tracked equipment can be used.

A few areas are used as cropland. This soil is generally unsuited to corn, soybeans, and small grain and is poorly suited to grasses and legumes for hay. Erosion is a severe hazard in cultivated areas. Row crops and small grain can be grown occasionally in the less sloping areas if erosion is controlled and the soil is otherwise well managed. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, contour tillage, grassed waterways, a cropping sequence that includes grasses and legumes, and cover crops help to control erosion and improve tilth. The soil is well suited to no-till planting.

Most areas are pastured. This soil is moderately well suited or poorly suited to pasture. The less sloping areas are better suited than the steeper areas. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. The slope limits the use of most wheeled equipment.

This soil is poorly suited to dwellings and septic tank absorption fields because of the slope. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in most areas. If the less sloping areas are leveled during building site development, a retaining wall is needed to prevent the downslope movement of the soil. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Installing the distribution lines of septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Local roads should be built across the slope.

The woodland ordination symbol is 5R. The land capability classification is VIe. The pasture and hayland suitability group is A-2.

NgE—Negley loam, 25 to 35 percent slopes. This deep, steep, well drained soil is on the side slopes of Illinoian outwash terraces. Slopes are typically smooth and uniform. Most areas are long and narrow and are 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 3 inches thick. The subsurface layer is brown, friable loam about 3 inches thick. The upper part of the subsoil is yellowish red, firm loam and clay loam. The next part is strong brown and dark brown, firm gravelly clay loam and gravelly loam. The lower part to a depth of about 80 inches is yellowish red, firm gravelly clay loam. In some areas the surface layer is silt loam. In a few eroded areas, it is gravelly loam.

Included with this soil in mapping are small areas of Markland soils on benches. These soils have more clay in the subsoil than the Negley soil. They make up about 15 percent of most mapped areas.

Permeability is moderate or moderately rapid in the Negley soil. The available water capacity is moderate. Runoff is very rapid. The root zone is very strongly acid to slightly acid. The organic matter content is moderately low.

Most areas are wooded. This soil is well suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building skid trails and logging roads on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars or other measures that control runoff and erosion are needed. When trees are harvested, leaving strips of unharvested trees along the streams helps to control sedimentation. The slope limits the use of wheeled planting, mowing, spraying, and some wheeled logging equipment. Tracked equipment can be used.

Because of a very severe hazard of erosion and the steep slope, this soil is generally unsuited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is generally unsuitable as a site for buildings and septic tank absorption fields because of the slope.

The woodland ordination symbol is 5R. The land capability classification is VIe. The pasture and hayland suitability group is A-3.

OmA—Omulga silt loam, 0 to 3 percent slopes. This deep, nearly level, moderately well drained soil is on very slight rises in preglacial valleys. Slopes are typically smooth and uniform. Most areas are irregularly shaped and are 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 54 inches thick. The upper part is yellowish brown, mottled, friable silt loam; the next part is a fragipan of yellowish brown, mottled, firm and brittle silty clay loam; and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of about 80 inches is yellowish brown, mottled, friable silt loam. In some areas the subsoil has more sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Doles soils along drainageways and in depressions. Also included are small areas of Wyatt soils on convex slopes and small areas of soils without a fragipan. Wyatt soils have more clay in the subsoil than the Omulga soil. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Omulga soil and slow in the fragipan. The root zone is mainly restricted to the 24- to 36-inch zone above the fragipan. It is extremely acid to medium acid. The available water capacity of this zone is low. Runoff is slow. The potential for frost action is high. The organic matter content is moderately low. A perched seasonal high water table is at a depth of 24 to 42 inches during wet periods.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used as cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Maintaining stands of deep-rooted legumes is difficult because of the potential for frost action and the moderately deep root zone above the fragipan. The soil dries out slowly in the spring. Subsurface drains lower the seasonal high water table. These drains are more effective if they are installed on or above the slowly permeable fragipan. Maintaining tilth and the organic matter content is the major management concern. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. A system of conservation tillage that leaves crop residue on the surface most of the year, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes increase the infiltration rate, minimize surface crusting, improve tilth, and increase the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

A few areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. The soil is droughty in summer. Warm-season grasses, such as switchgrass and big bluestem, grow well on droughty soils. Limited grazing during winter and other wet periods minimizes compaction. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is moderately well suited to dwellings. Because of seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Backfilling along foundations and footings with material that has a low shrink-swell potential minimizes the damage caused by shrinking and swelling. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by low strength and by frost action.

This soil is poorly suited to septic tank absorption fields because of the slow permeability in the fragipan and the seasonal wetness. The adverse effects of these limitations can be minimized by an aeration system. Enlarging the absorption field helps to overcome the restricted permeability. Perimeter subsurface drains lower the perched seasonal high water table. Properly landscaping the absorption field helps to divert surface water away from the field.

The woodland ordination symbol is 4A. The land capability classification is IIw. The pasture and hayland suitability group is F-3.

OmB—Omulga silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on slight rises in preglacial valleys. Slopes are typically smooth and uniform. Most areas are irregularly shaped and are 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown and yellowish brown, friable silt loam about 3 inches thick. The subsoil is about 54 inches thick. The upper part is yellowish brown, mottled, friable silt loam; the next part is a fragipan of yellowish brown, very firm and brittle silty clay loam; and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of about 80 inches also is yellowish brown, mottled friable silt loam. In some areas the subsoil has more sand. In a few areas in the smaller valleys, bedrock is at a depth of 40 to 60 inches. In places the subsoil has a higher content of thin, flat stone fragments.

Included with this soil in mapping are small areas of Doles, Richland, and Wyatt soils and scattered small areas of soils without a fragipan. The somewhat poorly drained Doles soils are in drainageways and depressions. Richland soils are on foot slopes. They do not have a fragipan. Wyatt soils have more clay in the subsoil than the Omulga soil. They are on knolls and along drainageways. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Omulga soil and slow in the fragipan. The root zone is mainly restricted to the 24 to 36 inches above the fragipan. It has a low available water capacity. It is medium acid to extremely acid. Runoff is medium. The potential for frost action is high. The organic matter content is moderately low. A perched seasonal high water table is at a depth of 24 to 42 inches during wet periods.

A few areas are wooded. This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas are used as cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. The erosion hazard is moderate in cultivated areas. Maintaining stands of deep-rooted legumes is difficult because of the potential for frost action and the moderately deep root zone above the fragipan. The soil dries out slowly in spring. Subsurface drains lower the seasonal high water table. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Grassed waterways, a system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes help to control erosion, increase the infiltration rate, minimize surface crusting, improve tilth, and increase the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

A few areas are pastured. This soil is well suited to

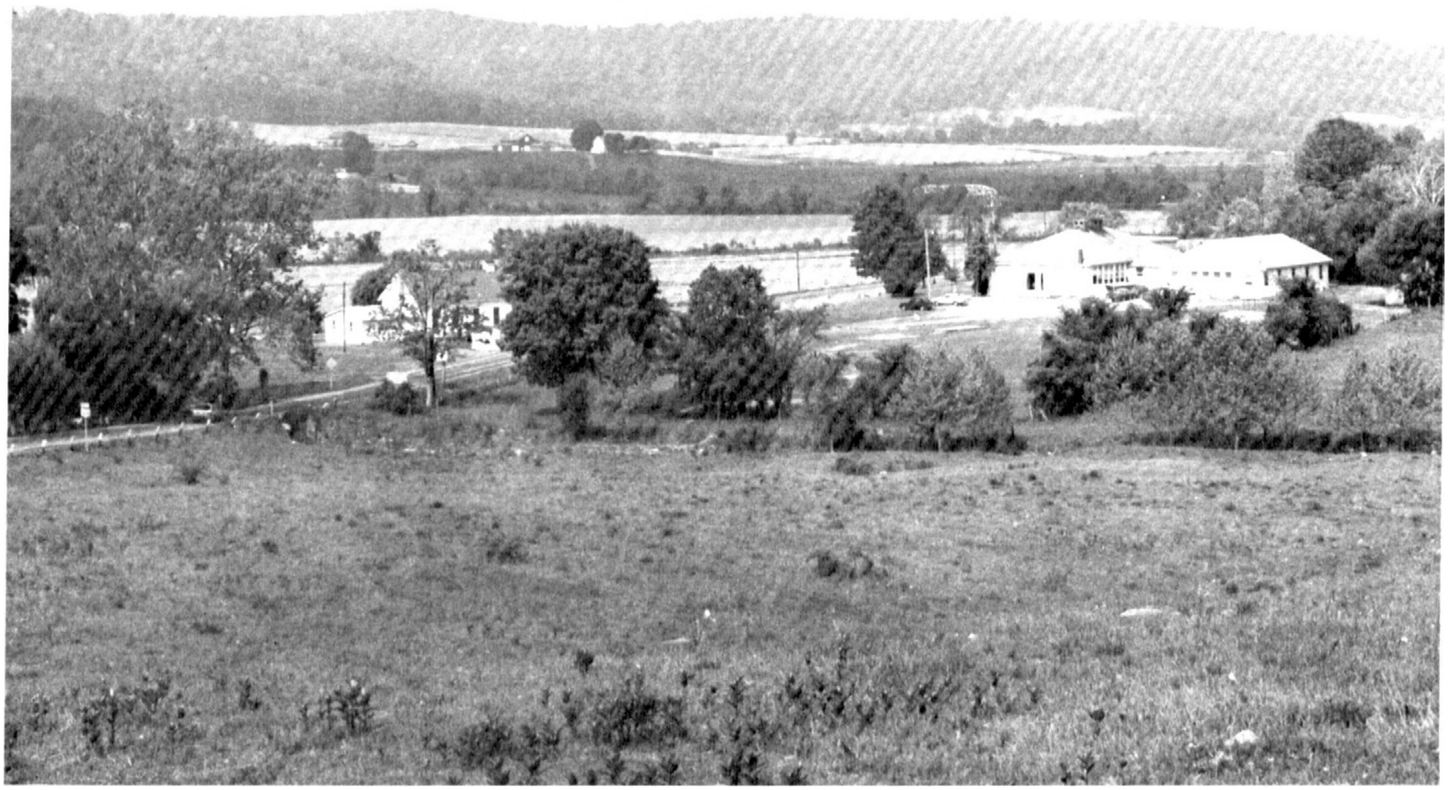

Figure 6.—Buildings on Omulga silt loam, 3 to 8 percent slopes.

pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. The soil is droughty in summer. Warm-season grasses, such as switchgrass and big bluestem, grow well. Limited grazing during winter and other wet periods minimizes compaction. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is moderately well suited to dwellings (fig. 6). Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Backfilling along foundations with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and by low strength. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion.

This soil is poorly suited to septic tank absorption fields because of the slow permeability and seasonal wetness. The effects of these limitations can be minimized by the use of an aeration system. Enlarging the absorption field helps to overcome the restricted permeability. Installing perimeter subsurface drains lowers the perched seasonal high water table. Properly landscaping the absorption field helps to divert surface water away from the field.

The woodland ordination symbol is 4A. The land capability classification is IIe. The pasture and hayland suitability group is F-3.

OmC—Omulga silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on side slopes, at the head of drainageways, and in high concave swales in preglacial valleys. Slopes are typically smooth and uniform. Most areas are long and narrow or are irregularly shaped. They are 5 to 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 54 inches thick. The upper part is yellowish brown, mottled, friable silt loam; the next part is a fragipan of yellowish brown, mottled, firm and brittle silty clay loam; and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of about 80 inches is yellowish brown, mottled, friable silt loam. In some areas the subsoil has more sand. In a few areas the soil has a higher content of coarse fragments.

Included with this soil in mapping are small areas of Allegheny Variant, Richland, and Wyatt soils and scattered small areas of soils without a fragipan. The well drained Allegheny Variant soils are on slope breaks above flood plains. Richland soils are on foot slopes. They do not have a fragipan. Wyatt soils are on knolls and along drainageways. They have more clay in the subsoil than the Omulga soil. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Omulga soil and slow in the fragipan. The root zone is mainly restricted to the 24 to 36 inches above the fragipan. It has a low available water capacity. It is medium acid to extremely acid. Runoff is rapid. The potential for frost action is high. The organic matter content is moderately low. A perched seasonal high water table is at a depth of 24 to 42 inches during wet periods.

A few areas are wooded. This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is used mainly as cropland. It is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay. The erosion hazard is severe in cultivated areas. Cultivated crops can be grown about once every 2 years if erosion is controlled and improved management is applied. Grassed waterways help to prevent gully erosion in areas where runoff concentrates. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone above the fragipan and the high potential for frost action. The soil dries out slowly in the spring. Subsurface drains lower the seasonal high water table. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes help to control erosion, increase the infiltration rate, minimize surface crusting, improve tilth, and increase the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

Some areas are pastured. This soil is moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. The soil is droughty in summer. Warm-season grasses, such as switchgrass and big bluestem, grow well. Limited grazing during winter and other wet periods minimizes compaction. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture help to protect the legumes against frost heaving.

This soil is moderately well suited to dwellings. Because of seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. The buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of foundations and coating the exterior of basement walls help to keep basements dry. Backfilling along foundations with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. Installing a drainage system and providing suitable base material minimizes the damage to local roads and streets caused by frost action and by low strength. Maintaining a protective vegetative cover or mulch on the site during construction helps to control erosion.

This soil is poorly suited to septic tank absorption fields because of the slow permeability and seasonal wetness. Enlarging the absorption field helps to overcome the restricted permeability. Perimeter subsurface drains lower the perched seasonal high water table. Installing the distribution lines across the slope helps to prevent seepage of effluent to the surface. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4A. The land capability classification is IIIe. The pasture and hayland suitability group is F-3.

OpD2—Opequon silt loam, 15 to 30 percent slopes, eroded. This shallow, moderately steep, well drained soil is on dissected side slopes along drainageways in the uplands. Slopes are generally uneven and complex. They are characterized by sharp breaks and are dissected by minor drainageways. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are long and narrow and are 50 to 250 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 3 inches thick. The subsoil is about 15 inches of strong brown, firm silty clay loam and yellowish red and reddish brown, very firm clay. Hard dolomitic limestone bedrock is at a depth of about 18 inches. In some areas the surface layer is thicker and darker. In a few places it is severely eroded and is silty clay loam.

Included with this soil in mapping are small areas of Latham and Trappist soils and limestone bedrock outcrops. The moderately deep Latham and Trappist soils are on the upper part of some slopes. The bedrock outcrops are along drainageways on the lower part of most slopes. Also included are a few severely eroded soils that have a silty clay surface layer in which tilth is poor. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow or moderate in the Opequon soil. The available water capacity is very low. Runoff is very rapid. The shrink-swell potential is high. The root zone is shallow and is medium acid to mildly alkaline. The organic matter content is moderately low.

Most areas are wooded. This soil is poorly suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building skid trails and logging roads on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars and other measures that control runoff and erosion are needed. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard. The clayey texture of the subsoil and the included areas of rock outcrop limit the use of wheeled planting, mowing, and spraying equipment and some wheeled logging equipment. Tracked equipment can be used.

Very few areas are used as cropland. Because of the droughtiness, the shallow root zone, a severe erosion hazard, and the slope, this soil is generally unsuited to corn and small grain and to grasses and legumes for hay.

A few areas are pastured. This soil is poorly suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. The use of wheeled equipment is limited on these short, moderately steep slopes. Maintaining stands of deep-rooted legumes is difficult because of the shallow root zone.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the slope, the shallowness to bedrock, the restricted permeability, and the high shrink-swell potential.

The woodland ordination symbol is 3R on north aspects, 2R on south aspects. The land capability classification is VIe. The pasture and hayland suitability group is E-1.

OoC2—Opequon-Bratton silt loams, 8 to 15 percent slopes, eroded. These strongly sloping, well drained soils are on shoulder slopes in the uplands. Slopes are typically uneven and are dissected by minor drainageways. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are irregularly shaped and are 5 to 50 acres in size. They are about 45 percent shallow Opequon silt loam and 40 percent moderately deep Bratton silt loam. The two soils occur in a random pattern and are so intricately mixed that it is not practical to separate them in mapping.

Typically, the Opequon soil has a surface layer of dark brown, friable silt loam about 3 inches thick. The subsoil is about 15 inches of strong brown, firm silty clay loam and yellowish red and reddish brown, very firm clay. Hard dolomitic limestone bedrock is at a depth of about 18 inches. In a few areas the soil has not been disturbed and is not eroded. In some areas the surface layer is darker.

Typically, the Bratton soil has a surface layer of dark brown, friable silt loam about 3 inches thick. The subsoil is about 27 inches thick. The upper part is strong brown, firm silty clay loam, and the lower part is yellowish red and reddish brown, firm silty clay and clay. The substratum is light yellowish brown, loose channery loamy sand. Hard dolomitic limestone bedrock is at a depth of about 35 inches. In some places the soil is deeper over bedrock. In other places the surface layer is silty clay loam.

Included with these soils in mapping are small areas of Latham and Trappist soils, limestone bedrock outcrops, and severely eroded soils. Latham and Trappist soils are in the higher landscape positions. They are underlain by shale bedrock and are more acid in the subsoil than the Opequon and Bratton soils. The bedrock outcrops are on the steeper slopes, on slope breaks, and in severely eroded areas. The severely eroded soils are on the upper part of some slopes. They have a silty clay surface layer in which tilth is poor. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the upper part of the Bratton soil and rapid directly above the bedrock. It is moderately slow or moderate in the Opequon soil. The available water capacity is low in the Bratton soil and very low in the Opequon soil. Runoff is rapid on both soils. The shrink-swell potential is high in the Opequon soil and moderate in the Bratton soil. The root zone is shallow in the Opequon soil and moderately deep in the Bratton soil. The root zone is medium acid to mildly alkaline in the Opequon soil and strongly acid to mildly alkaline in the Bratton soil. The organic matter content is moderately low in both soils.

Most areas have been cleared of trees but are reverting to grass and native tree species. The Bratton soil is better suited to woodland than the Opequon soil. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on the Opequon soil. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard on the Opequon soil. The clayey texture in the subsoil of the Opequon soil limits the use of some wheeled planting, mowing, spraying, and logging equipment. Tracked equipment can be used. Erosion on the Opequon soil can be controlled by building logging roads and skid trails on or nearly on the contour, installing water bars, or establishing a vegetative cover.

A few areas are used as cropland. These soils are poorly suited to corn and small grain and to grasses and legumes for hay. Erosion is a severe hazard in cultivated areas. Cultivated crops or small grain can be grown about once every 2 years if conservation practices are used and the soil is otherwise well managed. A cropping sequence that includes grasses and legumes, cover crops, contour tillage, and a mulch of crop residue help to control erosion, improve tilth, and increase the organic matter content. Grassed waterways help to prevent gully erosion in areas where runoff concentrates. The soils are well suited to no-till planting.

A few areas are pastured. These soils are moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a moderate hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. The slope limits the use of equipment in some areas. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone.

These soils are generally unsuitable as sites for buildings and septic tank absorption fields because of the depth to bedrock, the slope, the shrink-swell potential, and the restricted permeability. Because it is deeper to bedrock and has a lower shrink-swell potential, the Bratton soil is better suited to these uses than the Opequon soil. Stable building sites are available in some areas.

The woodland ordination symbol assigned to the Opequon soil is 3C, and the one assigned to the Bratton soil is 4A. The land capability classification is IVe. The pasture and hayland suitability group is E-1 for the Opequon soil and F-1 for the Bratton soil.

Or—Orrville silt loam, frequently flooded. This deep, nearly level, somewhat poorly drained soil is on narrow flood plains and in high water channels on broad flood plains. Slopes are 0 to 2 percent. Most areas are enlongated and are 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 80 inches is pale brown, light brownish gray, and yellowish brown, mottled, firm silt loam, loam, clay loam, sandy clay loam, and friable gravelly sandy clay loam. In some areas the surface layer is loam or sandy loam. In other areas it is darker.

Included with this soil in mapping are small areas of moderately well drained soils and the well drained Genesee and Huntington soils on the slightly higher parts of the flood plains. Also included are a few areas of the well drained Elkinsville soils on low stream terraces. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Orrville soil. The available water capacity is high. Runoff is very slow.

The organic matter content is moderate. The root zone is strongly acid or medium acid. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. The potential for frost action is high.

This soil is well suited to woodland. The species selected for planting should be those that can grow well on a somewhat poorly drained soil.

Except for a few scattered woodlots, most areas have been cleared of trees and are used mainly for corn or soybeans. This soil is moderately well suited to cropland. Planting is often delayed because the soil dries out slowly in spring. Subsurface drains lower the seasonal high water table. Planting cover crops, minimizing tillage, and incorporating crop residue into the plow layer help to maintain tilth, minimize crusting, and protect the surface layer in areas that are subject to scouring by floodwater.

A few areas are pastured. This soil is moderately well suited to pasture. Meadows can be damaged by flooding and the deposition of sediment. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding and the seasonal wetness.

The woodland ordination symbol is 5A. The land capability classification is IIw. The pasture and hayland suitability group is C-3.

OwA—Otwell silt loam, 0 to 3 percent slopes. This deep, nearly level, moderately well drained soil is on outwash terraces. Slopes are typically uneven or irregular. Most areas are irregularly shaped and are 10 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 73 inches thick. The upper part is yellowish brown and brown, friable and firm silt loam; the next part is a fragipan of yellowish brown, mottled, very firm and brittle silty clay loam; and the lower part is strong brown, mottled, firm clay loam. In some areas the subsoil has more sand and gravel.

Included with this soil in mapping are small areas of the somewhat poorly drained Taggart soils along drainageways and in depressions, small areas of Negley soils on slope breaks, and scattered small areas of soils without a fragipan. Negley soils contain more sand and gravel in the subsoil than the Otwell soil. Included soils make up about 10 percent of most mapped areas.

Permeability is very slow in the fragipan of the Otwell soil. Runoff is slow. The root zone is mainly restricted to the 24 to 36 inches above the fragipan. The available water capacity of this zone is low. The subsoil is strongly acid or very strongly acid. The potential for frost action is high. The organic matter content is moderately low. A perched seasonal high water table is at a depth of 24 to 42 inches during wet periods.

This soil is well suited to woodland. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Most areas have been cleared of trees and are used as cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Maintaining stands of deep-rooted legumes is difficult because of the high potential for frost action and the fragipan at a depth of 24 to 36 inches. Planting is often delayed because the soil dries out slowly in spring. Subsurface drains lower the seasonal high water table in the wetter areas. Maintaining tilth and the organic matter content is the major management concern. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. A system of conservation tillage that leaves crop residue on the surface most of the year, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes increase the infiltration rate, minimize crusting, and help to maintain tilth and the organic matter content. Tilling within the proper range of moisture minimizes compaction.

Some areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone and the potential for frost action. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is moderately well suited to dwellings. Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Backfilling along foundations with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling.

Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and by low strength.

This soil is poorly suited to septic tank absorption fields because of the very slow permeability and the seasonal wetness. These limitations can be minimized by using an aeration system. Enlarging the field helps to overcome the restricted permeability. Installing perimeter subsurface drains around the absorption field reduces the wetness. Properly landscaping the absorption field helps to divert surface water away from the field.

The woodland ordination symbol is 3D. The land capability classification is IIw. The pasture and hayland suitability group is F-3.

OwB—Otwell silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on outwash terraces. Slopes are typically uneven. Most areas are irregularly shaped and are 5 to 45 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 73 inches thick. The upper part is yellowish brown and brown, friable and firm silt loam; the next part is a fragipan of yellowish brown, mottled, very firm and brittle silt loam and silty clay loam; and the lower part is strong brown, mottled, firm clay loam. In some areas the subsoil has more sand and gravel.

Included with this soil in mapping are small areas of the somewhat poorly drained McGary and Taggart soils along drainageways, small areas of Negley and Markland soils on slope breaks, and scattered small areas of soils without a fragipan. Negley soils contain more sand and gravel in the subsoil than the Otwell soil, and Markland soils contain more clay in the subsoil. Also included are some strongly sloping areas. Included soils make up about 15 percent of most mapped areas.

Permeability is very slow in the fragipan of the Otwell soil. Runoff is medium. The root zone is mainly restricted to the 24 to 36 inches above the fragipan. The available water capacity of this zone is low. The subsoil is very strongly acid or strongly acid. The potential for frost action is high. The organic matter content is moderately low. A perched seasonal high water table is at a depth of 24 to 42 inches during wet periods.

This soil is well suited to woodland. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Most areas have been cleared of trees and are used as cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. The erosion hazard is moderate in cultivated areas. Row crops can be grown year after year if erosion is controlled. Maintaining stands of deep-rooted legumes is difficult because of the potential for frost action and the moderately deep root zone. Planting is often delayed because the soil dries out slowly in spring. Subsurface drains lower the seasonal water table in some of the wetter areas. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Grassed waterways, no-till planting and other systems of conservation tillage that leave crop residue on the surface most of the year, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes help to control erosion, increase the infiltration rate, minimize crusting, improve tilth, and increase the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

A few areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone and the potential for frost action. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving. Limited grazing during winter and other wet periods minimizes compaction.

This soil is moderately well suited to dwellings. Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Backfilling along foundations with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and by low strength. Maintaining a protective vegetative cover or mulch on the site during construction helps to control erosion.

This soil is poorly suited to septic tank absorption fields because of the very slow permeability and the seasonal wetness. These limitations can be minimized by using an aeration system. Enlarging the field helps to overcome the restricted permeability. Installing perimeter subsurface drains around the absorption field reduces the wetness. Properly landscaping the absorption field helps to divert surface water away from the field.

The woodland ordination symbol is 3D. The land capability classification is IIe. The pasture and hayland suitability group is F-3.

PaA—Parke silt loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on broad Illinoian outwash plains and terraces. Areas generally are on slight rises and typically have slightly convex, uniform slopes. Most areas are irregularly shaped and are 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 65 inches thick. The upper part is yellowish brown and strong brown, firm silt loam, and the lower part is strong brown and brown, firm sandy clay loam, gravelly clay loam, and gravelly loam. In some areas the lower part of the subsoil has more silt. In a few places the surface layer is dark brown. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the somewhat poorly drained Taggart soils on toe slopes, along drainageways, and in slight depressions and areas of Negley soils on dissected slopes. Negley soils have less silt in the upper part than the Parke soil. Also included are a few areas where a dense, brittle layer is in the lower part of the subsoil. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the Parke soil. The available water capacity is high. Runoff is slow. The subsoil is strongly acid or very strongly acid. The potential for frost action is high. The organic matter content is moderately low. The surface layer crusts after heavy rainfall.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used for corn, soybeans, or wheat or for grasses and legumes for hay. This soil is well suited to those crops. The erosion hazard is slight in cultivated areas. Maintaining tilth and the organic matter content is the major management concern. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. A system of conservation tillage that leaves crop residue on the surface most of the year, grassed waterways, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes increase the infiltration rate, improve tilth, increase the organic matter content, and minimize crusting. The soil is well suited to no-till planting. Tilling within the proper range of moisture content minimizes compaction.

Only a few areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is well suited to dwellings and septic tank absorption fields. Properly landscaping building sites and septic tank absorption fields helps to divert surface water away from foundations and from the absorption fields. Backfilling along foundations and footings with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. Providing suitable base material minimizes the damage to local roads and streets caused by frost action and by low strength.

The woodland ordination symbol is 5A. The land capability classification is I. The pasture and hayland suitability group is A-6.

PaB—Parke silt loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is along minor drainageways on broad Illinoian outwash plains and terraces. Slopes are typically slightly convex and uniform. Most areas are irregularly shaped and are 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 67 inches thick. The upper part is yellowish brown and strong brown, firm silt loam, and the lower part is strong brown, firm sandy clay loam and gravelly clay loam. In some areas the lower part of the subsoil has more silt. In a few places the surface layer is dark brown. In places the soil is moderately well drained.

Included with this soil in mapping are small areas of the somewhat poorly drained Taggart soils on toe slopes, along drainageways, and in slight depressions and areas of Negley soils on dissected slopes. Negley soils have less silt in the upper part than the Parke soil. Also included are a few small areas where a dense, brittle layer is in the lower part of the subsoil. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Parke soil. The available water capacity is high. Runoff is medium. The subsoil is strongly acid or very strongly acid. The potential for frost action is high. The organic matter content is moderately low. The surface layer crusts after heavy rainfall.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used for corn, soybeans, or wheat or for grasses and legumes for hay. This soil is well suited to those crops. The erosion hazard is moderate in cultivated areas. Maintaining tilth and the organic matter content is the major management concern. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. A system of conservation tillage that leaves crop residue on the surface most of the year, grassed waterways, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes increase the infiltration rate, improve tilth, increase organic matter content, and minimize erosion and surface crusting. The soil is well suited to no-till planting. Tilling within the proper range of moisture content minimizes compaction.

Only a few areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is well suited to dwellings and septic tank absorption fields. Backfilling along foundations and footings with material that has a low shrink-swell potential minimizes the structural damage caused by shrinking and swelling. Providing suitable base material minimizes the damage to local roads and streets caused by frost action and by low strength. Maintaining a protective vegetative cover or mulch on the site during construction helps to control erosion.

The woodland ordination symbol is 5A. The land capability classification is IIe. The pasture and hayland suitability group is A-6.

Pe—Peoga silt loam. This deep, nearly level, poorly drained soil is in depressions on Illinoian terraces and outwash plains. Slopes are slightly concave and even. They are 0 to 2 percent. Most areas are irregularly shaped and are 10 to 50 acres in size.

Typically, the surface layer is dark gray, friable silt loam about 12 inches thick. The subsoil is about 51 inches of light brownish gray and grayish brown, mottled, firm silt loam, silty clay loam, and clay loam. The substratum to a depth of about 75 inches is grayish brown, mottled, firm, stratified clay and clay loam. In a few areas the subsoil has more clay. In some areas the soil is somewhat poorly drained.

Included with this soil in mapping are small areas of the well drained Parke soils in the slightly higher positions on the landscape. These soils make up about 10 percent of most mapped areas.

Permeability is slow in the Peoga soil. The available water capacity is high. Runoff is very slow. The subsoil is very strongly acid to medium acid. The organic matter content is moderately low. The potential for frost action is high. A seasonal high water table is near the surface during extended wet periods. The surface layer crusts after heavy rainfall.

A few areas are wooded. This soil is moderately well suited to woodland. Because of excessive wetness, the equipment limitation is severe. The wetness limits mechanical tree planting and harvesting. Harvesting or planting when the soil is dry or frozen minimizes this limitation. The tree species selected for planting should be those that grow well on a soil with a seasonal high water table. Special site preparation, such as bedding or another kind of surface drainage system, reduces the seedling mortality rate. Harvesting procedures that do not leave the remaining trees widely spaced reduce the windthrow hazard. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Some areas are used for corn, soybeans, or small grain or for grasses and legumes for hay. If drained, this soil is moderately well suited to crops. Planting is often delayed because the soil dries out slowly in spring. Surface and subsurface drains lower the seasonal high water table. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Planting cover crops, incorporating crop residue into the plow layer, including grasses and legumes in the cropping sequence, and applying a system of conservation tillage that leaves crop residue on the surface most of the year increase the infiltration rate, improve tilth, and minimize surface crusting. Deferring fieldwork when the soil is wet minimizes compaction.

Most areas are pastured. This soil is moderately well suited to pasture. Improvement of the drainage system is needed in most areas. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction. Because of the seasonal wetness, the use of equipment is limited and maintaining stands of deep-rooted legumes is difficult. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is poorly suited to dwellings and septic tank absorption fields. Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Land grading improves surface drainage. Subsurface drains are needed around foundations. Backfilling around footings with limestone gravel, using polyethylene sheeting, or applying a protective wall coating minimizes the corrosion of concrete. Providing suitable base material and installing a drainage system minimize the damage to local roads and streets caused by frost action, seasonal wetness, and low strength. Enlarging septic tank absorption fields helps to overcome the slow permeability. Perimeter subsurface drains lower the seasonal high water table.

The woodland ordination symbol is 5W. The land capability classification is IIIw. The pasture and hayland suitability group is C-2.

Pg—Pits, gravel. This map unit occurs as areas on outwash terraces from which gravel is mined for use in construction. These areas are adjacent to Fox soils, which are underlain by outwash of sand and gravel. The pits generally range from 5 to 60 acres in size. Active ones are continually being enlarged. Most pits have a high wall on one or more sides. The bottom usually is covered with water. The level of this water fluctuates seasonally with the water table.

The mined material occurs as strata of gravel and sand of varying thickness and orientation. The kind and grain size of the aggregates are relatively uniform within any one layer but commonly differ from layer to layer. Some layers contain a significant amount of silt and sand. Selective mining commonly is feasible.

The material that remains after mining is poorly suited to plants. The organic matter content and available water capacity are low or very low. Permeability is very rapid. The material generally is alkaline. Most abandoned gravel pits can be developed for use as wildlife habitat or as recreational areas. Pits excavated to or below the level of the water table can be developed as habitat for wetland wildlife.

No woodland ordination symbol, land capability classification, or pasture and hayland suitability group has been assigned.

Pn—Pits, quarry. This map unit consists of surface-mined areas from which limestone or sandstone is or has been removed for use in construction and industry. In most areas limestone and sandstone conglomerate bedrock is close to the surface. Typically, limestone quarries are adjacent to areas of Opequon and Bratton soils and sandstone conglomerate quarries are adjacent to Brownsville, Clymer, and Gilpin soils. The quarries generally range from 5 to 50 acres in size. Active ones are continually being enlarged. Most quarries have a high wall on one or more sides.

The mined material consists of cemented sand and quartz pebbles in the areas sandstone conglomerate. The material mined in the limestone quarries consists of dense, hard, gray, dolomitic limestone.

The material that remains after mining is poorly suited to plants. The organic matter content and available water capacity are low or very low. Permeability is very rapid. The conglomerate areas generally are medium acid to extremely acid, and the limestone areas are strongly alkaline. Most abandoned quarries can be developed for wildlife habitat or as recreation areas. Pits excavated to or below the level of the water table can be developed as habitat for wetland wildlife.

No woodland ordination symbol, land capability classification, or pasture and hayland suitability group has been assigned.

PrB—Princeton fine sandy loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on bluffs that are preglacial valley remnants along the Scioto River. Slopes typically are slightly convex and smooth. Most areas are long and narrow and are 5 to 20 acres in size.

Typically, the surface layer is brown, friable fine sandy loam about 12 inches thick. The subsoil is about 54 inches thick. The upper part is brown and strong brown, firm fine sandy loam and loam, and the lower part is brown and dark brown, mottled, friable and very friable fine sandy loam, loamy sand, and sandy loam. The substratum to a depth of about 86 inches is strong brown and brown, mottled, friable, stratified silt loam and sandy loam. In some areas the surface layer is loam, sandy loam, or silt loam. In other areas the subsoil has less sand. In a few areas the soil is nearly level or strongly sloping. In places it has more sand throughout.

Included with this soil in mapping are small areas of Omulga soils in the lower landscape positions. These soils have a fragipan. They make up about 5 percent of most mapped areas.

Permeability is moderate in the Princeton soil. The available water capacity is moderate or high. Runoff is medium. The organic matter content is moderately low.

Unless the soil is limed, the subsoil is strongly acid to slightly acid.

This soil is well suited to woodland. No hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used for corn or small grain or for grasses and legumes for hay. This soil is well suited to those crops. Controlling erosion and maintaining tilth and the organic matter content are management concerns. A system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes improve tilth, increase the organic matter content, and help to control erosion.

Most areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species.

This soil is well suited to dwellings and septic tank absorption fields. The sides of shallow excavations can cave in unless they are reinforced or are dug back. Providing suitable base material minimizes the damage to local roads and streets caused by frost action.

The woodland ordination symbol is 5A. The land capability classification is IIe. The pasture and hayland suitability group is A-1.

PrC—Princeton fine sandy loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on slightly dissected bluffs that are preglacial valley remnants along the Scioto River. Slopes are typically smooth and uniform and in some areas are dissected by drainageways. Most areas are irregularly shaped and are 5 to 35 acres in size.

Typically, the surface layer is brown, friable fine sandy loam about 8 inches thick. The subsoil is about 56 inches thick. The upper part is brown and strong brown, firm fine sandy loam and loam, and the lower part is brown and dark brown, friable and very friable fine sandy loam, loamy sand, and sandy loam. The substratum to a depth of about 86 inches is strong brown, friable silt loam. In some areas the surface layer is loam, sandy loam, or silt loam. In other areas the subsoil has less sand. In a few areas the soil is gently sloping or steep. In a few places the lower part of the subsoil has gray mottles.

Included with this soil in mapping are small areas of Omulga soils and scattered areas where residual clay is in the substratum. Omulga soils have a fragipan. They are at the lower elevations. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the Princeton soil. The available water capacity is moderate or high. Runoff is rapid. The organic matter content is moderately low. Unless the soil is limed, the subsoil is strongly acid to slightly acid.

A few areas are wooded. This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Some areas are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Cultivated crops can be grown about once every 2 years if erosion is controlled and improved management is applied. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, grassed waterways, and a cropping sequence that includes grasses and legumes help to control erosion and improve tilth.

Most areas are pastured. This soil is moderately well suited to pasture. If the pasture is overgrazed or is plowed during seedbed preparation, erosion is a moderate hazard. It can be controlled by using no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, moving for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species.

This soil is only moderately well suited to dwellings and septic tank absorption fields because of the slope. Buildings should be designed so that they conform to the natural slope of the land. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent seepage of the effluent to the surface. Providing suitable base material minimizes the damage to local roads caused by frost action. Maintaining a vegetative cover or mulch on the site during construction reduces the runoff rate and helps to control erosion.

The woodland ordination symbol is 5A. The land capability classification is IIIe. The pasture and hayland suitability group is A-1.

PrD—Princeton fine sandy loam, 15 to 30 percent slopes. This deep, moderately steep, well drained soil is on strongly dissected bluffs that are preglacial valley remnants along the Scioto River. Slopes are typically smooth and uniform and are dissected by drainageways. Most areas are long and narrow and are 20 to 50 acres in size.

Typically, the surface layer is brown, friable fine sandy loam about 4 inches thick. The subsoil is about 60 inches thick. The upper part is brown and strong brown, firm fine sandy loam and loam, and the lower part is brown and dark brown, friable and very friable fine sandy loam, loamy sand, and sandy loam. The substratum to a depth of about 78 inches is strong brown, friable silt loam. In some areas the surface layer is loam, sandy loam, or silt loam. In a few areas the subsoil has less sand. In places the soil is very steep. In a few places the lower part of the subsoil has gray mottles.

Included with this soil in mapping are narrow strips of Shelocta soils where a mantle of windblown fine sand and silt is thin or does not occur. Also included are a few areas where sandstone and shale fragments are in the lower part of the subsoil and in the substratum. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Princeton soil. The available water capacity is moderate or high. Runoff is very rapid. The organic matter content is moderately low. The subsoil is strongly acid to slightly acid.

Most areas are wooded. This soil is well suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less transpiration and cooler temperature. These sites are less exposed to the drying effects of the prevailing winds. Building skid trails and logging roads on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars or other measures that control runoff and erosion are needed. The slope limits the use of wheeled planting and mowing equipment and some wheeled logging equipment. Tracked equipment can be used.

Some areas are pastured, and a few areas are used for hay. This soil is generally unsuited to corn, soybeans, and small grain because of the slope. It is moderately well suited or poorly suited to pasture and poorly suited to hay. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. The slope limits the use of most wheeled equipment.

This soil is poorly suited to dwellings and septic tank absorption fields because of the slope. Buildings should be designed so they conform to the natural slope of the land. Land shaping is needed in most areas. If the less sloping areas are excavated during building site development, a retaining wall is needed to prevent the downslope movement of the soil. Maintaining a protective vegetative cover or mulch on the site during construction helps to control erosion. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of the effluent to the surface. Local roads should be built across the slope.

The woodland ordination symbol is 5R. The land capability classification is VIe. The pasture and hayland suitability group is A-2.

Pu—Purdy Variant silt loam. This deep, nearly level, poorly drained soil is in depressions in preglacial valleys. Slopes are smooth and concave and are 0 to 2 percent. Most areas are irregularly shaped and are 5 to 80 acres in size.

Typically, the surface layer is grayish brown, mottled, friable silt loam about 8 inches thick. The subsoil is about 42 inches thick. The upper part is light brownish gray and grayish brown, mottled, friable silty clay loam and firm silty clay, and the lower part is gray and greenish gray, mottled, firm silty clay and very firm clay. The substratum to a depth of about 80 inches is grayish brown and dark yellowish brown, mottled, very firm and firm clay. In some areas the surface layer is silty clay loam. In a few areas the soil is somewhat poorly drained. In a few places the subsoil has less clay. In places the substratum has calcareous sediments.

Included with this soil in mapping are small areas in the lower parts of depressions that are occasionally ponded. Also included are small areas of the moderately well drained Wyatt and Omulga soils on slight rises. These soils are near the edge of the mapped areas. Included soils make up about 10 percent of most mapped areas.

Permeability is slow in the Purdy Variant soil. The available water capacity is moderate. Runoff is very slow. If the soil is drained, the root zone is deep. The subsoil is extremely acid to strongly acid. The potential for frost action is high. The seasonal high water table is near the surface during extended wet periods. The organic matter content is moderately low. The surface layer crusts after heavy rainfall.

This soil is well suited to woodland. Because of excessive wetness, the equipment limitation is severe. The wetness limits mechanical tree planting and mowing. The trees can be harvested when the soil is dry or frozen. Special site preparation, such as bedding or another kind of surface drainage system, reduces the seedling mortality rate. Increasing planting rates or replanting can offset the seedling mortality rate.

Planting seedlings that have been transplanted once reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Most areas have been cleared of trees and are used for corn, soybeans, or small grain or for grasses and legumes for hay. If drained, this soil is moderately well suited to crops. Maintaining stands of deep-rooted legumes is difficult because of frost action and the seasonal high water table. Planting is often delayed because the soil dries out slowly in spring. Surface and subsurface drains lower the seasonal high water table. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Planting cover crops, incorporating crop residue into the plow layer, and including grasses and legumes in the cropping sequence increase the infiltration rate, improve tilth, and minimize surface crusting. Deferring fieldwork when the soil is wet minimizes compaction.

A few areas are pastured. This soil is moderately well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction. The seasonal wetness limits the use of equipment and shortens the life of deep-rooted legumes. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixtures helps to protect the legumes against frost heaving.

This soil is poorly suited to dwellings and septic tank absorption fields. Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Ditches and subsurface drains around foundations improve drainage. Backfilling the excavations around walls and foundations with limestone gravel, using polyethylene sheeting, or applying a protective wall coating minimizes the corrosion of concrete. Providing suitable base material and installing a drainage system minimize the damage to local roads and streets caused by frost action, seasonal wetness, and low strength. Properly landscaping building sites and septic tank absorption fields helps to divert surface water away from foundations and from the absorption fields. Enlarging the fields helps to overcome the slow permeability. Perimeter subsurface drains lower the seasonal high water table.

The woodland ordination symbol is 5W. The land capability classification is IIIw. The pasture and hayland suitability group is C-2.

RdC—Rarden silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, moderately well drained and well drained soil is on hillsides and ridgetops in the uplands. Slopes are typically smooth or even and slightly convex. Most areas are long and narrow and are 5 to 30 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is strong brown, firm silty clay loam and silty clay, and the lower part is strong brown and yellowish red; mottled, firm clay. Strong brown and light gray, soft, thinly bedded shale bedrock is at a depth of about 36 inches. In some areas the subsoil has more silt in the upper part. In other areas the soil is deeper to bedrock. In many places the surface layer is silty clay loam. In a few areas the soil is underlain by hard sandstone bedrock. In places the subsoil is not so red.

Included with this soil in mapping are small areas of Blairton, Gilpin, Shelocta, and Wharton soils. These soils have less clay in the subsoil than the Rarden soil. Blairton and Gilpin soils are in narrow bands on the upper parts of slopes. Shelocta and Wharton soils are on foot slopes. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Rarden soil. The available water capacity is low. Runoff is rapid. The root zone is moderately deep. The potential for frost action and the shrink-swell potential are high. The subsoil is extremely acid to medium acid. The organic matter content is moderately low. The seasonal high water table is at a depth of 24 to 36 inches during wet periods.

Most areas are wooded. This soil is moderately well suited to woodland. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the windthrow hazard.

Some areas are used as cropland. This soil is moderately well suited to corn and small grain and to grasses and legumes for hay. Row crops and small grain can be grown about once every 2 years if erosion is controlled and improved management is applied. The erosion hazard is severe in cultivated areas, especially if the slopes are long. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, contour farming, grassed waterways, a cropping sequence that includes grasses and legumes, cover crops, and incorporation of crop residue into the plow layer help to control erosion, minimize surface crusting, increase the infiltration rate, improve tilth, and increase the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

Many areas are pastured. This soil is moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone.

This soil is moderately well suited to dwellings. Because of the seasonal wetness and the depth to bedrock, it is better suited to dwellings without basements than to dwellings with basements. Reinforcing footings and foundations minimizes the structural damage caused by shrinking and swelling. Backfilling the excavations around foundations and walls with material that has a low shrink-swell potential also minimizes this damage. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Buildings should be designed so that they conform to the natural slope of the land. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and by low strength. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective coating around footings minimizes the corrosion of concrete. Erosion is a serious hazard during construction. It can be controlled by maintaining a protective vegetative cover or mulch on the site during construction.

This soil is poorly suited to septic tank absorption fields. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface. Placing the lines in a mound of suitable fill material helps to elevate the field above the bedrock and improves the ability of the field to absorb effluent. Installing interceptor drains upslope from the absorption field reduces the seasonal wetness.

The woodland ordination symbol is 4C. The land capability classification is IIIe. The pasture and hayland suitability group is F-1.

RdD—Rarden silt loam, 15 to 25 percent slopes. This moderately deep, moderately steep, moderately well drained and well drained soil is on hillsides in the uplands. Slopes are typically smooth. Most areas are long and narrow or are circular. They are 10 to 80 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is strong brown, firm silty clay loam and silty clay, and the lower part is strong brown and yellowish red, mottled, firm clay. Strong brown and light gray, soft, thinly bedded shale bedrock is at a depth of about 36 inches. In some areas the upper part of the subsoil has more silt. In other areas the soil is deeper to bedrock. In many places the surface layer is silty clay loam. In some places the soil is underlain by hard sandstone bedrock. In other places the subsoil is not so red.

Included with this soil in mapping are small areas of Gilpin, Shelocta, and Wharton soils. These soils have less clay in the subsoil than the Rarden soil. Gilpin soils are in narrow bands on the upper parts of slopes and on the higher ridgetops. Shelocta and Wharton soils are on foot slopes. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Rarden soil. The available water capacity is low. Runoff is rapid. The subsoil is extremely acid to medium acid. The root zone is moderately deep. The potential for frost action and the shrink-swell potential are high. The organic matter content is moderately low. The seasonal high water table is at a depth of 24 to 36 inches during wet periods.

Many areas are wooded. This soil is moderately well suited to woodland. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building skid trails and logging roads on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars or other measures that control runoff and erosion are needed. The slope limits the use of wheeled planting, mowing, and spraying equipment and some wheeled logging equipment. Tracked equipment can be used. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Frequent, light thinning and harvesting can increase the vigor of the stand and reduce the windthrow hazard.

A few areas are used for corn or small grain or for grasses and legumes for hay. This soil is generally unsuited to crops. The erosion hazard is very severe in cultivated areas. Row crops can be grown occasionally in the less sloping areas if erosion is controlled and the soil is otherwise well managed. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, contour stripcropping, grassed waterways, a cropping sequence that includes grasses and legumes, cover crops, and incorporation of crop residue into the plow layer help to control erosion, minimize surface crusting, improve tilth, and increase the infiltration rate and the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

Some areas are pastured. This soil is moderately well suited or poorly suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forages species. The slope limits the use of some wheeled equipment.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the slope, the depth to bedrock, the slow permeability, the seasonal wetness, the high shrink-swell potential, and hillside slippage.

The woodland ordination symbol is 3R. The land capability classification is VIe. The pasture and hayland suitability group is F-1.

RhC—Richland silt loam, clayey substratum, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on foot slopes of steep upland hillsides along the north edge of the main preglacial valley. Slopes are generally smooth, but a few areas along shallow drainageways are irregular. Seeps are common. Most areas are long and narrow and are 15 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is light yellowish brown, friable silt loam about 3 inches thick. The subsoil is about 53 inches thick. The upper part is strong brown, firm silt loam; the next part is yellowish brown, mottled, firm silt loam, channery loam, and channery silty clay loam; and the lower part is yellowish brown and dark brown, mottled, very firm channery silty clay and silty clay. The substratum to a depth of about 75 inches is dark brown, mottled, very firm, clay. In some areas the upper and middle parts of the subsoil are thicker. A few areas are moderately steep. In a few places the upper part of the subsoil has gray mottles. In a few areas the surface layer is channery silt loam or channery loam.

Included with this soil in mapping are small areas of somewhat poorly drained soils. These soils commonly have a surface layer that is darker than that of the Richland soil. Also included are small areas of the moderately well drained Omulga and Wyatt soils on foot slopes and toe slopes and the well drained Shelocta soils on hillsides. Shelocta soils have less clay in the lower part of the subsoil than the Richland soil. Included soils make up about 20 percent of most mapped areas.

Permeability is moderate in the upper part of the subsoil in the Richland soil and slow or very slow in the lower part and in the substratum. Runoff is rapid. The available water capacity is moderate. A perched seasonal high water table is at a depth of 36 to 72 inches. The organic matter content is moderately low. Unless the soil is limed, the root zone is strongly acid to slightly acid. The shrink-swell potential is moderate in the upper part of the subsoil and high in the lower part and in the substratum.

Most areas are wooded. This soil is well suited to woodland. No major hazards or limitations affect planting and harvesting.

Some areas are used as cropland. This soil is moderately well suited to corn and small grain and to grasses and legumes for hay. Erosion is a severe hazard. Cultivated crops or small grain can be grown about once every 2 years if conservation practices are used. No-till planting or another system of conservation tillage that leaves crop residue on the surface, cover crops, grassed waterways, and a cropping sequence that includes grasses and legumes help to control erosion, improve tilth, and increase the rate of water infiltration. Diversions can be used in some areas to intercept runoff from the adjacent slopes. Subsurface drains lower the water table in seeps and in some of the wetter included soils.

Many areas are pastured. This soil is moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species.

This soil is only moderately well suited to dwellings because of the slope, the seasonal wetness, and the high shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Designing walls with pilasters and reinforcing them with concrete or supporting the walls on a large spread footing minimizes the damage caused by shrinking and swelling. Backfilling the excavations around foundations and footings with material that has a low shrink-swell potential also minimizes this damage. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and by low strength. Driveways and local roads and streets should be built across the slope.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow or very slow permeability. Installing perimeter subsurface and interceptor drains upslope from the absorption field helps to lower the water table. Enlarging the absorption field helps to overcome the restricted permeability. Installing the distribution lines on the contour helps to prevent lateral seepage of effluent to the surface.

The woodland ordination symbol is 4A. The land capability classification is IIIe. The pasture and hayland suitability group is A-1.

ShD—Shelocta silt loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on uneven foot slopes in the uplands. Most areas are long and narrow and are 10 to 70 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, firm channery silty clay loam, and the lower part is brownish yellow and yellowish brown, firm channery silt loam. The substratum to a depth of about 72 inches is yellowish brown, firm channery silt loam.

Included with this soil in mapping are small areas of Brownsville, Latham, and Skidmore Variant soils. Brownsville and Latham soils occur in a random pattern throughout the mapped areas. Brownsville soils have a higher content of coarse fragments in the subsoil than the Shelocta soil. The moderately deep Latham soils have more clay in the subsoil than the Shelocta soil. Skidmore Variant soils are on alluvial fans. They have a higher content of coarse fragments in the subsoil than the Shelocta soil. Included soils make up about 15 percent of most mapped areas.

Permeability and the available water capacity are moderate in the Shelocta soil. Runoff is very rapid. The subsoil is strongly acid or very strongly acid. The organic matter content is moderately low.

Some areas are wooded. This soil is well suited to woodland. North- and east-facing slopes and coves are better sites for woodland than the south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building logging roads and skid trails on or nearly on the contour facilitates the use of equipment and minimizes runoff and erosion. Water bars, a vegetative cover, or other measures that control erosion are needed. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. The slope limits the use of some wheeled logging equipment. Tracked equipment can be used. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil, but caution is needed. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south-facing slopes.

A few areas are used as cropland. This soil is poorly suited to crops. The erosion hazard is very severe in cultivated areas. Cultivated crops can be grown about once every 4 years if erosion is controlled and the soil is otherwise well managed. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, grassed waterways, a cropping sequence that includes grasses and legumes, cover crops, and incorporation of crop residue into the plow layer help to control erosion, improve tilth, and increase the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

Many areas are pastured. This soil is moderately well suited or poorly suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. The slope limits the use of some wheeled equipment.

This soil is poorly suited to dwellings and septic tank absorption fields because of the slope, a hazard of slippage, and the bedrock at a depth of more than 48 inches. Land shaping is needed in most areas. If the area is cut and filled during building site development, a retaining wall is needed to prevent the downslope movement of the soil. Diversions are needed upslope from some buildings. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent lateral seepage of the effluent to the surface. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Local roads should be built across the slope.

The woodland ordination symbol is 4R. The land capability classification is IVe. The pasture and hayland suitability group is A-2.

SnF—Shelocta-Brownsville association, steep. This association consists of deep, steep, well drained soils on hillsides in the uplands. The Shelocta soil is commonly on foot slopes, benches, and the mid and lower parts of side slopes, and the Brownsville soil is on the upper parts of side slopes and in areas above the benches. Seeps and hillside slips are common. Slopes are dominantly 25 to 40 percent. Most are uneven and benched, but some are smooth. Areas are 40 to thousands of acres in size and are irregularly shaped. Most are about 40 percent Shelocta channery silt loam and 35 percent Brownsville channery silt loam. Because of present and anticipated land uses, it was not considered practical or necessary to separate these soils at the scale used in mapping.

Typically, the Shelocta soil has partially decomposed leaf litter at the surface. The surface layer is dark grayish brown, friable channery silt loam about 11 inches thick. The subsoil is about 31 inches thick. The upper part is brown, firm channery silt loam, and the lower part is strong brown and brown, firm channery silty clay loam. The substratum to a depth of about 68 inches is yellowish brown, dark grayish brown, and light brownish gray, very firm channery silty clay loam. In some areas the subsoil is not so thick. In a few areas the soil is moderately well drained. In places the subsoil and substratum have more sand.

Typically, the Brownsville soil has partially decomposed leaf litter at the surface. The surface layer is very dark gray, very friable channery silt loam about 4 inches thick. The subsoil is about 40 inches thick. The upper part is dark yellowish brown and brown, firm and friable channery silt loam, and the lower part is yellowish brown and pale brown, firm and very firm channery silt loam, extremely channery silt loam, and extremely channery silty clay loam. The subsoil is mottled below a depth of about 34 inches. The substratum is light yellowish brown, mottled, very firm very channery silt loam. Weathered, fine grained sandstone bedrock is at a depth of about 48 inches. In some areas the depth to bedrock is less than 40 inches. In other areas the surface layer is thicker.

Included with these soils in mapping are areas of Blairton, Clifty, Coolville, Gilpin, Latham, Rarden, Tilsit, and Trappist soils and droughty, shallow or moderately deep soils. Blairton, Gilpin, Latham, Rarden, and Trappist soils are moderately deep over bedrock. Clifty soils irregularly decrease in organic matter content with increasing depth. Coolville soils have more clay in the subsoil than the Shelocta and Brownsville soils. Tilsit soils have a fragipan. Blairton and Coolville soils are on ridgetops and shoulder slopes. Clifty soils are on narrow flood plains. Gilpin and Rarden soils are on narrow ridgetops. Latham soils occur as bands on hillsides. Also included are sandstone escarpments on the upper part of slopes. Areas of the included soils are less than 20 acres in size. They make up about 25 percent of the association.

Permeability is moderate or moderately rapid in the Brownsville soil and moderate in the Shelocta soil. The available water capacity is low in the Brownsville soil and moderate in the Shelocta soil. Runoff is very rapid on both soils. The subsoil of the Brownsville soil is extremely acid to strongly acid, and that of the Shelocta soil is very strongly acid or strongly acid. The organic matter content is moderately low in both soils.

Nearly all of this association is wooded. These soils are moderately well suited to woodland. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building logging roads and skid trails on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars or other measures that control erosion and runoff are needed on the Shelocta soil. After trees are harvested, seeding log landings, skid trails, and logging roads helps to control erosion. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Leaving strips of unharvested trees along streams in the harvest area helps to control sedimentation. Hillside slippage of the Shelocta soil and the slope of both soils limit the use of wheeled planting and spraying equipment and some wheeled logging equipment. Tracked equipment can be used. Plant competition on north-facing slopes in areas of the Shelocta soil can be controlled by removing vines and the less desirable trees and shrubs. Benches are commonly used as sites for logging roads and skid trails.

A few of the less sloping areas are pastured. These soils are generally unsuitable as cropland and pasture because the dominant slopes are too steep to be managed for these uses.

This association is generally unsuitable for building

Figure 7.—Road damage caused by slippage of the Shelocta soil in an area of the Shelocta-Brownsville association, steep.

site development and onsite waste disposal because of the slope of both soils and the hazard of hillside slippage in areas of the Shelocta soil (fig. 7).

The woodland ordination symbol assigned to the Shelocta soil is 4R, and the one assigned to the Brownsville soil is 4R on the north aspects, 3R on the south aspects. The land capability classification is VIIe. The pasture and hayland suitability group is A-3 for the Shelocta soil and B-2 for the Brownsville soil.

SoF—Shelocta-Rigley association, steep. This association consists of deep, well drained, steep soils on hillsides in the uplands. The Shelocta soil is on the lower and middle parts of side slopes, and the Rigley soil is on the upper concave parts. Seeps and hillside slips are common in some areas. Slopes are dominantly 25 to 40 percent. Most slopes are smooth, but some have narrow benches and sharp breaks at sandstone escarpments. Areas are generally elongated and are 100 to 2,500 acres in size. They are about 50 percent Shelocta silt loam and 25 percent Rigley channery fine sandy loam. Because of present and anticipated land uses, it was not considered practical or necessary to separate these soils at the scale used in mapping.

Typically, the Shelocta soil has partially decomposed leaf litter at the surface. The surface layer is brown, friable silt loam about 5 inches thick. The subsoil is yellowish brown, firm very channery and channery silt loam about 43 inches thick. The substratum is brownish yellow and yellowish brown, firm very channery silt loam. Fine grained sandstone is at a depth of about 62 inches. In some areas the soil is moderately well drained.

Typically, the Rigley soil has partially decomposed leaf litter at the surface. The surface layer is dark brown channery fine sandy loam about 6 inches thick. The subsoil is about 44 inches of strong brown and brown, firm loam and gravelly loam. It is mottled between depths of about 31 and 39 inches. The substratum to a depth of about 60 inches is strong brown, loose sand. In some areas the subsoil has more sand or clay.

Included with these soils in mapping are areas of Blairton, Brownsville, Clifty, Gilpin, Latham, and Rarden soils and areas of excessively drained, shallow or moderately deep soils. Blairton, Gilpin, Latham, and Rarden soils are moderately deep over bedrock. Blairton soils are on ridgetops and shoulder slopes. Gilpin, Latham, and Rarden soils are on ridgetops. Brownsville soils have a higher content of coarse fragments in the subsoil than the Shelocta and Rigley soils. They are on the lower parts of side slopes. Clifty soils are on narrow flood plains. They have a lower content of clay in the subsoil than the Shelocta and Rigley soils. The excessively drained, shallow or moderately deep soils are on narrow ridgetops and at the base of bedrock escarpments. Also included are sandstone escarpments on the upper parts of side slopes. Areas of the included soils are less than 20 acres in size. They make up about 25 percent of the association.

Permeability is moderately rapid in the Rigley soil and moderate in the Shelocta soil. The available water capacity is moderate in both soils. Runoff is very rapid. The organic matter content is moderately low. The root zone is deep. The subsoil of the Shelocta soil is strongly acid or very strongly acid, and that of the Rigley soil is strongly acid to extremely acid.

Most areas are wooded. These soils are moderately well suited to woodland and are well suited to woodland wildlife habitat. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building skid trails and logging roads on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars or other measures that control erosion and runoff are needed. Seeding log landings, skid trails, and logging roads after trees are harvested helps to control erosion. Filter strips or buffer strips between the harvest area and watercourses help to control sedimentation. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south-facing slopes. A hazard of hillside slippage on the Shelocta soil and the slope of both soils limit the use of wheeled planting and spraying equipment and some wheeled logging equipment. Tracked equipment can be used. Plant competition on north-facing slopes in areas of the Shelocta soil can be controlled by removing vines and the less desirable trees and shrubs.

A few of the less sloping areas are pastured. These soils are generally unsuitable as cropland and pasture because of the slope and the erosion hazard.

These soils are generally unsuitable as sites for buildings and septic tank absorption fields because of the slope. Developing sites for recreational and urban uses is very difficult because of the slope. Hillside slippage is a hazard on the Shelocta soil. The hazard of erosion is high if the vegetative cover is removed. Trails in recreation areas should be protected against erosion and should be established across the slope if possible.

The woodland ordination symbol assigned to the Shelocta soil is 4R, and the one assigned to the Rigley soil is 4R on north aspects, 3R on south aspects. The land capability classification is VIIe. The pasture and hayland suitability group is A-3.

SpF—Shelocta-Latham association, steep. This association consists of steep soils on hillsides in the uplands. The deep, well drained Shelocta soil is on the middle and lower parts of side slopes, and the moderately deep, moderately well drained Latham soil is on the upper parts of side slopes and on shoulder slopes. Seeps and hillside slips are common. Slopes are dominantly 25 to 40 percent. Most are smooth and are dissected along a few drainageways. Areas are irregularly shaped and are 20 to 2,000 acres in size. Most are about 50 percent Shelocta silt loam and 25 percent Latham silt loam. Because of present and anticipated land uses, it was not considered practical or necessary to separate these soils at the scale used in mapping.

Typically, the Shelocta soil has partially decomposed leaf litter at the surface. The surface layer is dark grayish brown, friable silt loam about 11 inches thick. The subsoil is about 31 inches of strong brown, yellowish brown, and brownish yellow, firm silt loam and channery silty clay loam. The substratum to a depth of about 68 inches is varigated yellowish brown, light brownish gray, and very dark grayish brown, very firm channery silty clay loam. In some areas the subsoil is thinner. In a few areas the soil is moderately well drained. In places the subsoil and substratum have fewer coarse fragments and more sand.

Typically, the Latham soil has partially decomposed leaf litter at the surface. The surface layer is brown, very friable silt loam about 2 inches thick. The subsurface layer is yellowish brown, firm silt loam about 6 inches thick. The subsoil is about 26 inches thick. The upper part is reddish yellow, firm silty clay loam, and the lower part is strong brown and light olive brown, mottled, firm silty clay and channery silty clay. Soft shale bedrock is at a depth of about 34 inches. In some areas the subsoil is redder. In other areas the soil is deep over bedrock. In a few areas the subsoil has less clay.

Included with these soils in mapping are areas of Blairton, Brownsville, Clifty, Coolville, and Gilpin soils and areas of well drained, shallow or moderately deep soils. Blairton, Coolville, and Gilpin soils are on ridgetops and shoulder slopes. Blairton soils are wetter than the Shelocta soil and have less clay in the subsoil than the Latham soil. Coolville soils have more silt in the upper part than the Shelocta and Latham soils. Gilpin soils are not so deep over bedrock as the Shelocta soil and are better drained than the Latham soil. Brownsville soils occur as bands on hillsides. They have a higher content of coarse fragments in the subsoil than the Shelocta and Latham soils. Clifty soils are on narrow flood plains. They have less clay in the subsoil than the Shelocta and Latham soils. The well drained, shallow or moderately deep soils are on narrow ridgetops. Areas of the included soils are less than 20 acres in size. They make up about 25 percent of the association.

Permeability is moderate in the Shelocta soil and slow in the Latham soil. The available water capacity is moderate in the Shelocta soil and low in the Latham soil. Runoff is very rapid on both soils. The organic matter content is moderately low. The Latham soil has a high shrink-swell potential and a high potential for frost action. The subsoil of the Shelocta soil is strongly acid or very strongly acid, and that of the Latham soil is very strongly acid or extremely acid. The Latham soil has a seasonal high water table at a depth of 18 to 36 inches during wet periods.

Most of the acreage is wooded. These soils are moderately well suited to woodland. The Shelocta soil is better suited than the Latham soil. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Building skid trails and logging roads on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars or other measures that control erosion and runoff are needed. Seeding log landings, skid trails, and logging roads after trees are harvested helps to control erosion. Filter strips or undisturbed buffer strips between the harvest area and watercourses help to control sedimentation. Plant competition can be controlled by removing vines and the less desirable trees and shrubs on north aspects in areas of the Shelocta soil. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Slope and a hazard of hillside slippage limit the use of wheeled planting and spraying equipment and some wheeled logging equipment. Tracked equipment can be used. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard on the Latham soil.

A few of the less sloping areas are pastured. These soils are generally unsuitable as cropland and pasture because of the slope.

These soils are generally unsuitable as sites for buildings and septic tank absorption fields because of the slope and hazard of hillside slippage on both soils and the slow permeability, seasonal wetness, high shrink-swell potential, and moderate depth to bedrock in the Latham soil. Developing sites for recreational and urban uses is very difficult, and the hazard of erosion is very high when vegetation is removed. Most slopes are unstable and are subject to slippage. The stability of the soils should be evaluated prior to cutting and filling. Trails in recreation areas should be protected against erosion and should be established across the slope if possible.

The woodland ordination symbol assigned to the Shelocta soil is 4R, and the one assigned to the Latham soil is 4R on north aspects, 3R on south aspects. The land capability classification is VIIe. The pasture and hayland suitability group is A-3 for the Shelocta soil and F-2 for the Latham soil.

SrA—Skidmore Variant gravelly loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on stream terraces. Slopes are typically smooth. Most areas are irregularly shaped and are 5 to 25 acres in size.

Typically, the surface layer is brown, friable gravelly loam about 9 inches thick. The subsoil is about 26 inches of dark brown and strong brown, friable and firm gravelly silt loam and extremely gravelly loam. The substratum to a depth of about 80 inches is brown and yellowish brown, loose very channery loam. In a few places the subsoil is thicker. In some areas it has fewer coarse fragments. In other areas it is more alkaline. In a few areas bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Clifty and Haymond soils on flood plains, small areas of the somewhat poorly drained Stendal soils in the slightly lower positions on flood plains, and Elkinsville soils on low stream terraces. Clifty and Haymond soils have fewer coarse fragments than the Skidmore Variant soil. Elkinsville soils have fewer coarse fragments in the subsoil than the Skidmore Variant soil. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately rapid in the Skidmore Variant soil. The available water capacity is moderate. Runoff is slow. The root zone is deep. This soil has a highly corrosive effect on concrete. The subsoil is strongly acid or very strongly acid. The organic matter content is moderately low.

A few areas are wooded. This soil is well suited to trees, especially black walnut (fig. 8). No major hazards or limitations affect planting or harvesting.

This soil is used mainly for cropland. It is well suited to corn and small grain and to grasses and legumes for hay. Some areas cannot be easily cropped because they are dissected by drainageways into small, narrow tracts. Measures that maintain tilth and the organic matter content, conserve moisture, and increase the rate of water infiltration are the main management needs. Examples are tilling within the proper moisture range, incorporating crop residue into the plow layer, including grasses and legumes in the cropping sequence, applying a system of no-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, and growing cover crops. Because plant nutrients are easily leached, plants on this soil respond better to small, frequent and timely applications of lime and fertilizer than to one large application.

A few areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species.

This soil is well suited to dwellings and septic tank absorption fields. Using polyethylene sheeting or applying a protective wall coating minimizes the corrosion of concrete. Replacing the surface layer and subsoil with suitable base material minimizes the damage to local roads and streets caused by frost action.

The woodland ordination symbol is 5A. The land capability classification is IIs. The pasture and hayland suitability group is B-1.

SrB—Skidmore Variant gravelly loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on stream terraces and alluvial fans. Slopes are typically smooth and slightly convex. Most areas are irregularly shaped and are 5 to 15 acres in size.

Typically, the surface layer is brown, friable gravelly loam about 9 inches thick. The subsurface layer is dark brown, friable gravelly silt loam about 5 inches thick. The subsoil is about 21 inches of strong brown, firm gravelly silt loam and extremely gravelly loam. The substratum to a depth of about 80 inches is brown and yellowish brown, loose very channery loam. In some areas the subsoil is thicker. In other areas it has fewer coarse fragments. In a few places it is more alkaline. In a few areas bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Clifty and Haymond soils on flood plains, Shelocta soils on foot slopes, Stendal soils in the lower positions on flood plains, and Elkinsville soils on low stream terraces. The included soils have fewer coarse fragments than the Skidmore Variant soil. They make up about 15 percent of most mapped areas.

Permeability is moderately rapid in the Skidmore Variant soil. The available water capacity is moderate. The root zone is deep. Runoff is medium. This soil has a highly corrosive effect on concrete. The subsoil is strongly acid or very strongly acid. The organic matter content is moderately low.

A few areas are wooded. This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas are used as cropland. This soil is well

Figure 8.—Black walnut trees planted in an area of Skidmore Variant gravelly loam, 0 to 3 percent slopes.

suited to corn and small grain and to grasses and legumes for hay. Some areas cannot be easily cropped because they are dissected by drainageways into small, narrow tracts. Measures that maintain tilth and the organic matter content, conserve moisture, and increase the rate of water infiltration are the main management needs. Examples are no-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes. Because plant nutrients are easily leached, plants on this soil respond better to small, frequent and timely applications of lime and fertilizer than to one large application.

Some areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species.

This soil is well suited to dwellings and septic tank absorption fields. Using polyethylene sheeting or a protective wall coating minimizes the corrosion of concrete. Replacing the surface layer and subsoil with suitable base material minimizes the damage to local roads and streets caused by frost action.

The woodland ordination symbol is 5A. The land capability classification is IIe. The pasture and hayland suitability group is B-1.

Ss—Stendal silt loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. Slopes are 0 to 2 percent. Most areas are long and narrow and are 10 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The substratum to a depth of about 72 inches is brown, grayish brown, and light brownish gray, mottled, friable silt loam. In some areas the substratum has less clay. In a few areas the soil has more sand.

Included with this soil in mapping are small areas of the moderately well drained Wilbur and well drained Haymond soils on slight rises. Also included are small areas of the poorly drained Melvin soils in depressions. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the Stendal soil. The available water capacity is very high. The organic matter content is moderate. Runoff is slow. The root zone is strongly acid or very strongly acid. The seasonal high water table is at a depth of 12 to 36 inches during extended wet periods. The potential for frost action is high.

A few scattered woodlots are in areas of this soil. The soil is well suited to woodland. The species selected for planting should be those that grow well on a somewhat poorly drained soil.

Most areas have been cleared of trees and are used for corn or soybeans. If drained, this soil is well suited to cropland. Such crops as winter wheat and hay can be damaged by floodwater. Planting is often delayed because the soil dries out slowly in spring. Subsurface drains can lower the seasonal high water table. Surface drains are used to remove excess surface water. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Planting cover crops, minimizing tillage, and incorporating crop residue into the plow layer help to maintain tilth, minimize surface crusting, increase the infiltration rate, and protect the surface in areas that are subject to scouring by floodwater.

A few areas are pastured. If drained, this soil is well suited to pasture. Meadows can be damaged by flooding and the deposition of sediment. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction. Subsurface drains can lower the seasonal high water table.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding and the seasonal wetness.

The woodland ordination symbol is 5A. The land capability classification is IIw. The pasture and hayland suitability group is C-3.

St—Stonelick loam, occasionally flooded. This deep, nearly level, well drained soil is on broad flood plains. Slopes are 0 to 2 percent. Most areas are long and narrow and are 10 to 100 acres in size.

Typically, the surface layer is brown, friable loam about 9 inches thick. The subsurface layer is dark grayish brown, friable loam about 3 inches thick. The substratum is about 27 inches of brown, stratified loose sand and friable and very friable sandy loam. Below this to a depth of about 60 inches is a buried surface layer of very dark grayish brown, friable silt loam. In places the soil has more sand throughout. In some areas the surface layer is silt loam or sandy loam. In other areas the soil is gently sloping. In a few areas it has more clay throughout.

Included with this soil in mapping are small areas of Huntington soils in the slightly higher positions on the flood plains. These soils have a surface layer that is darker than that of the Stonelick soil. They make up about 10 percent of most mapped areas.

Permeability is moderately rapid in the Stonelick soil. The available water capacity is moderate. Runoff is very slow. The root zone is neutral to moderately alkaline. The organic matter content is moderately low.

A small acreage is wooded. This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas are used for row crops, such as corn and soybeans. This soil is moderately well suited to crops. Flooding is the main hazard, but it usually occurs before row crops are planted. Crops such as winter wheat and hay can be damaged by floodwater. The soil is droughty during extended dry periods. Applying a system of no-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, incorporating crop residue into the plow layer, and tilling within the optimum range of moisture content help to maintain the organic matter content, conserve moisture, and improve tilth. Johnsongrass cannot be easily controlled in most areas. Herbicides are commonly used. Because plant nutrients are easily leached, plants on this soil respond better to small, frequent applications of fertilizer than to one large application.

A few areas are pastured. This soil is moderately well suited to grasses and legumes for pasture and hay. Meadows can be damaged by flooding and the deposition of sediment. The soil is droughty during extended dry periods. Warm-season grasses, such as switchgrass and big bluestem, grow well on droughty soils. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of fertilizer help to maintain the stand of key forage species.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding.

The woodland ordination symbol is 4A. The land capability classification is IIw. The pasture and hayland suitability group is A-5.

TgA—Taggart silt loam, 0 to 4 percent slopes. This deep, nearly level and gently sloping, somewhat poorly drained soil is in slight depressions on Illinoian outwash plains and terraces. Slopes are typically smooth, even, and slightly concave. Most areas are irregularly shaped and are 20 to 75 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 63 inches thick. The upper part is brownish yellow, yellowish brown, and light brownish gray, mottled, friable and firm silt loam and silty clay loam, and the lower part is strong brown, mottled, firm loam and clay loam. The substratum to a depth of about 84 inches is reddish yellow, mottled, friable sandy clay loam. In some areas the subsoil has more sand and less silt. In a few areas the soil is poorly drained.

Included with this soil in mapping are small areas of the well drained Parke and moderately well drained Otwell soils on slightly elevated parts of the landscape. Also included are the well drained Negley soils on side slopes on the edges of the mapped areas, areas where the subsoil is clay or silty clay and has a higher shrink-swell potential, and small intermingled areas of soils that have a fragipan. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Taggart soil. The available water capacity is high. Runoff is slow. The subsoil is very strongly acid or strongly acid. The organic matter content is moderately low. The potential for frost action is high. A seasonal high water table is at a depth of 12 to 36 inches during extended wet periods.

A few small woodlots are in areas of this soil. The soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is mainly used for corn, soybeans, or wheat or for grasses and legumes for hay. If drained, this soil is well suited to crops. Planting and harvesting are often delayed because the soil dries out slowly in spring and fall. Subsurface drains can lower the seasonal high water table. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Planting cover crops, incorporating crop residue into the plow layer, including grasses and legumes in the cropping sequence, and applying a system of conservation tillage that leaves some crop residue on the surface most of the year improve tilth, increase the infiltration rate, and minimize surface crusting. Harvesting or planting when the soil is dry or frozen minimizes compaction. Adding lime according to the results of soil tests helps to maintain legume forage crops and increases the yields of other crops.

Some areas are pastured. If drained, this soil is well suited to pasture. A drainage system is needed in many areas. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction.

This soil is poorly suited to dwellings and septic tank absorption fields. Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Landscaping and installing subsurface drains around foundations improve drainage. Providing suitable base material and installing a drainage system minimize the damage to local roads and streets caused by frost action and by low strength. The slow permeability and the seasonal wetness limit the use of this soil as a site for septic tank absorption fields. Enlarging the field improves the ability of the soil to absorb effluent. Installing perimeter subsurface drains around the absorption field reduces the wetness.

The woodland ordination symbol is 4A. The land capability classification is IIw. The pasture and hayland suitability group is C-1.

Th—Taggart silt loam, rarely flooded. This deep, nearly level, somewhat poorly drained soil is on low stream terraces. Slopes are 0 to 2 percent. Most areas are oval or are long and narrow. They are 15 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 56 inches thick. It is yellowish brown and brown and is mottled. It is firm and very firm silty clay loam in the upper part and firm loam in the lower part. The substratum to a depth of about 84 inches is yellowish brown, mottled, firm, stratified silt loam, loam, and sandy loam. In a few areas the substratum is silty clay. In some areas the subsoil has more sand and less silt. In other areas the soil is poorly drained.

Included with this soil in mapping are small areas of moderately deep soils where the streams are running over bedrock. Also included are areas of Urban land used for building sites, parking lots, or roads. Inclusions make up about 15 percent of most mapped areas.

Permeability is slow in the Taggart soil. The available water capacity is high. Runoff is slow. The subsoil is very strongly acid or strongly acid. The organic matter content is moderate. The potential for frost action is high. A seasonal high water table is at a depth of 12 to 36 inches during extended wet periods.

A few scattered areas are wooded. This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used for corn or soybeans. If drained, this soil is well suited to crops. Planting and harvesting are often delayed because the soil dries out slowly in spring and fall. Subsurface drains can lower the seasonal high water table. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Planting cover crops, incorporating crop residue into the plow layer, including grasses and legumes into the cropping sequence, and applying a system of conservation tillage that leaves crop residue on the surface most of the year improve tilth, increase the infiltration rate, and minimize surface crusting. Harvesting or planting when the soil is dry or frozen minimizes compaction.

A few areas are pastured. If drained, this soil is well suited to pasture. A drainage system is needed in many areas. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction.

Some areas are reserved for urban development or are used as building sites. This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding, the seasonal wetness, and the slow permeability. Providing suitable base material and installing a drainage system minimize the damage to parking lots and to local roads and streets caused by frost action and by low strength.

The woodland ordination symbol is 4A. The land capability classification is IIw. The pasture and hayland suitability group is C-1.

TkA—Tilsit silt loam, 0 to 4 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on broad ridgetops in the uplands. Slopes are typically smooth and uniform. Most areas are irregularly shaped and are 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown, firm silt loam, and the lower part is a fragipan of yellowish brown, very firm and brittle silt loam and silty clay loam. The subsoil is mottled below a depth of about 17 inches. The substratum is yellowish brown, mottled, very firm channery silty clay loam. Hard, fine grained sandstone bedrock is at a depth of about 54 inches. In some areas the subsoil has more sand. In other areas the soil does not have a fragipan. In a few areas the lower part of the soil has a higher content of sandstone fragments.

Included with this soil in mapping are small areas of somewhat poorly drained soils in slight depressions and along drainageways and small areas of the moderately deep Gilpin and Rarden soils on the more sloping parts of the landscape. Also included are scattered small areas of Coolville soils, which have more clay in the subsoil than the Tilsit soil. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Tilsit soil and slow in the fragipan. The root zone is restricted mainly to the 18- to 28-inch zone above the fragipan. The available water capacity of this zone is low. Runoff is slow. The subsoil is strongly acid or very strongly acid. The organic matter content is moderately low. A seasonal high water table is at a depth of 18 to 30 inches during wet periods.

This soil is well suited to woodland. Weeds should be controlled by spraying or mowing if seedlings in plantations are to survive and grow well. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used as cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Planting is often delayed because the soil dries out slowly in spring. Subsurface drains can lower the seasonal high water table in some of the wetter areas. Both systematic and random drainage systems are used. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. A system of conservation tillage that leaves crop residue on the surface most of the year, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes increase the infiltration rate, minimize crusting, and help to maintain tilth and the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

Some areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Limited grazing during winter and other wet periods minimizes compaction. Maintaining stands of deep-rooted legumes is difficult because of the dense fragipan at a depth of 18 to 30 inches. Forage species that have a fibrous root system grow well. The soil is droughty in summer. Warm-season grasses, such as switchgrass and big bluestem, grow well on droughty soils.

This soil is moderately well suited to buildings and is poorly suited to septic tank absorption fields. Because of the seasonal wetness, it is better suited to dwellings without basements than to dwellings with basements. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and by low strength. Perimeter subsurface drains lower the seasonal high water table on sites for septic tank absorption fields. Enlarging the field helps to overcome the slow permeability. Properly landscaping the absorption field helps to divert surface water away from the field. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4A. The land capability classification is IIw. The pasture and hayland suitability group is F-3.

TrD—Trappist silt loam, 15 to 25 percent slopes. This moderately deep, moderately steep, well drained soil is on foot slopes in the uplands. Slopes are uneven. Hillside slips are common in some areas. Most areas are long and narrow and are 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 34 inches thick. The upper part is light yellowish brown, firm silt loam and strong brown, firm silty clay loam. The lower part is yellowish red, firm channery silty clay loam and channery silty clay. Dark reddish brown, yellowish red, and reddish brown, clayey shale is at a depth of about 37 inches. In some areas the depth to bedrock is more than 40 inches. In other areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the deep Omulga and Shelocta soils. Omulga soils are in the lower landscape positions, and Shelocta soils are in the higher positions. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Trappist soil. The available water capacity is low. Runoff is very rapid. The organic matter content is moderately low. The subsoil is strongly acid to extremely acid. The root zone is moderately deep.

Most areas are wooded. This soil is moderately well suited to woodland. Building logging roads and skid trails on or nearly on the contour facilitates the use of equipment and minimizes erosion. Water bars and other measures that control runoff and erosion are needed. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Slope and a hazard of hillside slippage limit the use of wheeled equipment. Tracked equipment can be used. The equipment used in mechanical tree planting and in mowing for weed control can be operated on this soil, but caution is needed. The trees selected for planting should be those that can grow well on a soil that has a high clay content in the subsoil.

A few areas are used as cropland. Because of the slope, the erosion hazard, and the low available water capacity, this soil is generally unsuited to row crops and small grain and to grasses and legumes for hay. Erosion is a very severe hazard in cultivated areas.

Some areas are pastured. This soil is moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by mulching or no-till seeding on the contour and by growing a cover crop or companion crop. Proper stocking rates, pasture rotation, weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. The slope limits the use of some wheeled equipment. Maintaining stands of deep-rooted legumes is difficult because of the moderately deep, acid root zone.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the slope, the hazard of slippage, the moderate depth to bedrock, and the moderately slow permeability.

The woodland ordination symbol is 3R. The land capability classification is VIe. The pasture and hayland suitability group is F-1.

TsF—Trappist-Shelocta association, steep. This association consists of steep, well drained soils on hillsides in the uplands. The moderately deep Trappist soil is on the middle and extreme lower parts of the hillsides and on narrow ridges and nose slopes on the lower parts of the landscape. The deep Shelocta soil is on the upper parts of concave slopes and in places is on the middle parts. Seeps and hillside slips are common. Slopes are dominantly 25 to 40 percent. Most are uneven. Benches and sharp breaks are near sandstone and shale bedrock escarpments. Some of the shorter slopes are smooth. Areas are irregularly shaped and are 300 to 400 acres in size. Most are about 40 percent Trappist silt loam and 35 percent Shelocta channery silt loam. Because of present and anticipated land uses, it was not considered practical or necessary to separate these soils at the scale used in mapping.

Typically, the Trappist soil has partially decomposed leaf litter at the surface. The surface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 34 inches thick. The upper part is light yellowish brown, firm silt loam and strong brown, firm silty clay loam. The lower part is yellowish red, firm channery silty clay loam and channery silty clay. The subsoil is mottled below a depth of about 31 inches. Yellowish red, highly weathered, soft shale bedrock is between depths of about 37 and 46 inches. Reddish brown, yellowish red, and dark reddish brown, clayey shale is below a depth of about 46 inches. In some areas the depth to bedrock is more than 40 inches.

Typically, the Shelocta soil has partially decomposed leaf litter at the surface. The surface layer is dark grayish brown, very friable channery silt loam about 3 inches thick. The subsurface layer is light yellowish brown, firm channery silt loam about 11 inches thick. The subsoil is yellowish brown and brownish yellow, firm very channery and channery silt loam about 38 inches thick. It is mottled below a depth of about 41 inches. Yellowish brown and strong brown, soft sandstone bedrock is at a depth of about 54 inches. In some areas the subsoil is thinner. In a few areas the subsoil has a higher content of coarse fragments. In a few places the soil is moderately well drained.

Included with these soils in mapping are areas of Blairton, Brownsville, Clifty, and Coolville soils; some areas of well drained, shallow soils; and areas where sandstone and shale bedrock crops out. The moderately well drained Blairton and Coolville soils are on ridgetops and shoulder slopes. Brownsville soils are on the upper parts of the slopes, directly below the shoulder slopes. They have a higher content of coarse fragments in the subsoil than the Trappist and Shelocta soils. Clifty soils are on narrow flood plains. They have less clay in the subsoil than the Trappist and Shelocta soils. The sandstone outcrops are at the head of drainageways. The shale outcrops are in mid-slope positions and along drainageways. The well drained, shallow soils are on narrow ridgetops. Areas of the included soils are less than 20 acres in size. They make up about 25 percent of the association.

Permeability is moderately slow in the Trappist soil and moderate in the Shelocta soil. The available water capacity is moderate in the Shelocta soil and low in the Trappist soil. Runoff is rapid on both soils. The organic matter content is moderately low. The subsoil of the Trappist soil is strongly acid to extremely acid, and that of the Shelocta soil is strongly acid or very strongly acid. The root zone is moderately deep in the Trappist soil and deep in the Shelocta soil.

Nearly all of this association is wooded. These soils are moderately well suited to woodland. North- and east-facing slopes and coves are better sites for woodland than south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are exposed to the drying effects of the prevailing winds. Building logging roads and skid trails on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars or other measures that control erosion and runoff are needed. Seeding log landings, skid trails, and logging roads after trees are harvested helps to control erosion. Filter strips or undisturbed buffer strips between the harvest area and watercourses help to control sedimentation. Plant competition on north-facing slopes in areas of the Shelocta soil can be controlled by removing vines and the less desirable trees and shrubs. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south aspects in areas of the Shelocta soil. The slope and a hazard of hillside slippage limit the use of wheeled planting and spraying equipment and some wheeled logging equipment. Tracked equipment can be used.

A few of the less sloping areas are pastured. These soils are generally unsuitable as cropland and pasture because of the slope, a severe erosion hazard, and droughtiness in the Trappist soil.

This association is generally unsuitable as a site for buildings and septic tank absorption fields because of the slope and hazard of hillside slippage in areas of both soils and the moderately slow permeability and the moderate depth to bedrock in the Trappist soil.

The woodland ordination symbol assigned to the Trappist soil is 3R, and the one assigned to the Shelocta soil is 4R. The land capability classification is VIIe. The pasture and hayland suitability group is F-2 for the Trappist soil and A-3 for the Shelocta soil.

UoA—Urban land-Omulga complex, 0 to 6 percent slopes. This map unit consists of Urban land and a deep, nearly level and gently sloping, moderately well drained Omulga soil in preglacial valleys. The unit occurs as one area nearly 1,500 acres in size and several smaller areas. The areas are about 70 percent Urban land and 20 percent Omulga silt loam. The Urban land and Omulga soil occur as areas so intricately mixed or small that separating them in mapping is not practical.

The Urban land is covered by roads, parking lots, buildings, and railroads that so obscure or alter the soil that identification of the soil series is not feasible.

Typically, the surface layer of the Omulga soil is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 54 inches thick. The upper part is yellowish brown, friable silt loam; the next part is a fragipan of yellowish brown, mottled, firm and brittle silty clay loam; and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of about 85 inches also is yellowish brown, mottled, friable silt loam. In some areas the subsoil has more sand. In many places the soil has been radically altered. In some of the low areas, it has been filled or leveled during construction, and in other areas it has been removed, built up, or smoothed.

Included with the Urban land and Omulga soil in mapping are a few small areas of the strongly sloping, moderately deep Rarden soils along the fringes of the unit and a few areas of the somewhat poorly drained Doles soils in slight depressions and along drainageways. Also included are small areas of soils that do not have a fragipan. These soils are intermingled with areas of the Omulga soil. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate above the fragipan in the Omulga soil and slow in the fragipan. The root zone is restricted mainly to the 24- to 36-inch zone above the fragipan. The available water capacity of this zone is low. Runoff is slow. The subsoil is medium acid to extremely acid. The potential for frost action is high. The organic matter content is moderately low. A perched seasonal high water table is at a depth of 24 to 42 inches during wet periods.

The Omulga soil is used for open areas, lawns, and wildlife habitat. It is well suited to trees, lawns, flowers, and shrubs. In some years garden planting is delayed because of seasonal wetness. The perennial species selected for planting should be those that are tolerant of a restricted root zone. Vegetation is difficult to establish in the small areas that have been cut and filled unless these areas are blanketed with topsoil. Erosion is a hazard where the soil is disturbed and the surface is bare.

The Omulga soil is moderately well suited to buildings and is poorly suited to septic tank absorption fields. Because of the seasonal wetness, the soil is better suited to dwellings without basements than tc dwellings with basements. Gutters and storm sewers are used in most areas. Installing drains at the base of footings and coating exterior walls help to keep basements dry. Backfilling along foundations with material that has a low shrink-swell potential minimizes the damage caused by shrinking and swelling. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and by low strength. The slow permeability and seasonal wetness are limitations on sites for septic tank absorption fields. These limitations can be minimized by an aeration system. Enlarging the absorption field helps to overcome the restricted permeability. Perimeter drains around the absorption field reduce the wetness.

No woodland ordination symbol, land capability classification, or pasture and hayland suitability group has been assigned.

WeB—Wernock Variant silt loam, 3 to 8 percent slopes. This moderately deep, gently sloping, moderately well drained soil is on narrow ridgetops in the uplands. Slopes are typically smooth and slightly convex. Most areas are long and narrow and are 15 to 50 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part is strong brown and yellowish brown, firm silty clay loam, and the lower part is yellowish brown, mottled, firm silty clay loam and silty clay. Soft shale bedrock is at a depth of about 38 inches. In some areas the soil is deep over bedrock.

Included with this soil in mapping are small areas of Gilpin and Tilsit soils. Gilpin soils have more sand and rock fragments in the subsoil than the Wernock Variant soil. They are on slight rises and the edges of ridgetops. The deep Tilsit soils are on broader, more nearly level parts of the ridgetops. Included soils make up about 10 percent of most mapped areas.

Permeability is moderate in the Wernock Variant soil. The available water capacity is low or moderate. Runoff is medium. The subsoil is strongly acid to extremely acid. A seasonal high water table is at a depth of 18 to 36 inches during wet periods. The organic matter content is moderately low. The potential for frost action is high.

This soil is well suited to woodland. Weeds should be controlled by spraying or mowing if seedlings are to survive and grow well. No major hazards or limitations affect planting or harvesting.

Most areas have been cleared of trees and are used as cropland. This soil is well suited to corn and small grain and to grasses and legumes for hay. Controlling erosion and maintaining tilth and the organic matter content are major management concerns. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. A system of conservation tillage that leaves crop residue on the surface most of the year, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes increase the infiltration rate, minimize crusting, help to control erosion, and maintain tilth and the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

Some areas are pastured. This soil is well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species..Maintaining stands of deep-rooted legumes is difficult because of the moderately deep root zone and the high potential for frost action. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is moderately well suited to dwellings and is poorly suited to septic tank absorption fields. Because of the seasonal wetness and the depth to bedrock, it is better suited to dwellings without basements than to dwellings with basements. Backfilling the excavations around walls and foundations with limestone gravel, using polyethylene sheeting, or applying a protective wall coating minimizes the corrosion of concrete. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Suitable fill material can elevate septic tank absorption fields a sufficient distance above the bedrock and improves the ability of the field to absorb effluent. Perimeter subsurface drains around the field lower the water table. An aeration sewage disposal system is used in some areas. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by frost action and by low strength.

The woodland ordination symbol is 4A. The land capability classification is IIe. The pasture and hayland suitability group is F-1.

WhD—Wharton silt loam, 15 to 25 percent slopes. This deep, moderately steep, moderately well drained soil is on hillsides in the uplands. Slopes are generally uneven and complex. Slope breaks and dissected areas are along minor drainageways. Most areas are irregularly shaped and are 10 to 70 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown and strong brown, firm silt loam and channery silty clay loam, and the lower part is yellowish brown and light olive brown, mottled, very firm channery silty clay loam and silty clay. The substratum to a depth of about 66 inches is light olive brown, mottled, very firm silty clay. In some areas the soil is well drained. In a few areas the lower part of the subsoil and the substratum have less clay and more sand. In places hard bedrock is below a depth of 40 inches. In a few areas the soil is moderately deep over bedrock.

Included with this soil in mapping are small areas of the moderately deep Latham and Rarden soils. These soils are on narrow ridgetops and are intermingled with areas of the Wharton soil on hillsides. They make up about 15 percent of most mapped areas.

Permeability is moderately slow or slow in the Wharton soil. The available water capacity is moderate. Runoff is rapid. The potential for frost action is high. Unless lime has been applied, the root zone is extremely acid to strongly acid. The seasonal high water table is at a depth of 18 to 36 inches during wet periods. The organic matter content is moderately low.

Some areas are wooded. This soil is well suited to woodland. North- and east-facing slopes are better sites for woodland than south- and west-facing slopes because they are characterized by less transpiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south aspects. The slope limits the use of wheeled planting and spraying equipment and some wheeled logging equipment. Tracked equipment can be used. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Building logging roads and skid trails on or nearly on the contour facilitates the use of equipment and helps to control erosion. Water bars or other measures that control runoff and erosion are needed.

A few areas are used as cropland. Most of the cropland is used for hay. This soil is poorly suited to row crops and small grain. The erosion hazard is very severe in cultivated areas. Cultivated crops can be grown occasionally if erosion is controlled and the soil is otherwise well managed. In a common crop rotation, cultivated crops are grown once every 4 years. No-till planting or another system of conservation tillage that leaves crop residue on the surface, contour stripcropping, a cropping system that includes grasses and legumes, cover crops, grassed waterways, and incorporation of crop residue into the plow layer help to control erosion, improve tilth, and increase the organic matter content. Tilling within the proper range of moisture content minimizes compaction.

Many areas are pastured. This soil is moderately well suited or poorly suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost action. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer reduce the hazard of erosion and help to maintain a good stand of key forage species. The slope limits the use of some wheeled equipment.

This soil is poorly suited to dwellings and septic tank absorption fields because of the slope, the seasonal wetness, and the moderately slow or slow permeability. Land shaping is needed in most areas. Where a building site is developed by cutting and filling, a retaining wall is commonly needed to prevent the downslope movement of the soil above the building site. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Installing interceptor drains upslope from septic tank absorption fields reduces the seasonal wetness. Enlarging the field helps to overcome the slow or moderately slow permeability. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by low strength and by frost action.

The woodland ordination symbol is 4R. The land capability classification is IVe. The pasture and hayland suitability group is A-6.

Wm—Wilbur silt loam, occasionally flooded. This deep, nearly level, moderately well drained soil is on flood plains in preglacial valleys. Slopes are typically smooth and are 0 to 2 percent. Most areas are irregularly shaped or are long and narrow. They are 30 to 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The substratum to a depth of about 66 inches is dark yellowish brown, yellowish brown, and grayish brown, mottled, friable and firm silt loam. In some areas the upper part of the soil has more sand or more clay. In other areas the substratum contains gravel. In a few places a very firm and brittle layer is below a depth of about 40 inches. In a few areas the soil is well drained.

Included with this soil in mapping are small areas of Doles, Melvin, Omulga, Stendal, and Wyatt soils. Doles and Omulga soils are in the higher positions in preglacial valleys. They have a fragipan. The poorly drained Melvin and somewhat poorly drained Stendal soils are in the lower positions on flood plains. Wyatt soils are on slope breaks and side slopes in preglacial valleys. They have more clay in the subsoil than the Wilbur soil. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Wilbur soil. The available water capacity is very high. Runoff is slow. Unless lime has been applied, the root zone is strongly acid to slightly acid. A seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. The potential for frost action is high. The organic matter content is moderately low.

A few areas are wooded. This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Most areas are used for corn or soybeans. This soil is well suited to crops. Planting is often delayed because the soil dries out slowly in spring. Subsurface drains lower the seasonal high water table in some of the wetter areas. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. Planting cover crops, incorporating crop residue into the plow layer, and including grasses and legumes in the cropping sequence increase the infiltration rate, improve tilth, and minimize surface crusting. Tilling within the proper range of moisture content minimizes compaction. Special measures are needed in places to control streambank erosion.

A few areas are pastured. This soil is well suited to pasture. Meadows may be damaged by flooding and the deposition of sediment. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the flooding and the seasonal wetness.

The woodland ordination symbol is 5A. The land capability classification is IIw. The pasture and hayland suitability group is A-5.

WyB2—Wyatt silty clay loam, 3 to 8 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is on knolls and side slopes adjacent to drainageways in preglacial valleys. Slopes are typically smooth and uniform. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are irregularly shaped and are 5 to 50 acres in size.

Typically, the surface layer is dark yellowish brown, friable silty clay loam about 6 inches thick. The subsoil is about 34 inches thick. It is yellowish brown. The upper part is firm silty clay loam, and the lower part is mottled, firm and very firm clay and silty clay. The substratum to a depth of about 64 inches is varigated yellowish brown and dark yellowish brown, very firm, varved clay, silty clay, and silt loam. It is mottled in the upper part. In some areas the surface layer is silt loam. In other areas the soil is well drained. In places it has gray mottles directly below the surface layer.

Included with this soil in mapping are small areas of Doles, Omulga, and Richland soils. Doles and Omulga soils are in the less sloping areas. They have a fragipan. Richland soils have a higher content of sand and coarse fragments in the upper part of the subsoil than the Wyatt soil. They are on foot slopes along the edge of valleys. Included soils make up about 10 percent of most mapped areas.

Permeability is slow or very slow in the Wyatt soil. The available water capacity is moderate. Runoff is medium. The subsoil is very strongly acid to medium acid. The shrink-swell potential and the potential for frost action are high. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. The organic matter content is moderately low. The root zone is deep.

A few areas are wooded. This soil is moderately well suited to woodland. The species selected for planting should be those that are tolerant of a high clay content in the subsoil. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Most areas are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Maintaining stands of deep-rooted legumes is difficult because of the seasonal wetness, the high shrink-swell potential, the high potential for frost action, and acidity in the subsoil. Planting is delayed in some years because the soil dries out slowly in spring. Subsurface drains can lower the seasonal high water table. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. The soil should be tilled only within a limited range of moisture content because it becomes compact and cloddy if it is worked when it is wet and sticky. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, incorporation of crop residue into the plow layer, cover crops, and a cropping sequence that includes grasses and legumes help to control erosion, improve tilth, increase the infiltration rate and the organic matter content, and minimize crusting.

Some areas are pastured. This soil is moderately well suited to pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to maintain the stand of key forage species. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is poorly suited to dwellings because of the seasonal wetness and the high shrink-swell potential. It is better suited to dwellings without basements than to dwellings with basements. Reinforcing foundations and footings minimizes the structural damage caused by shrinking and swelling. Backfilling the excavations around walls and foundations with material that has a low shrink-swell potential also minimizes this damage. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective wall coating around footings minimizes the corrosion of concrete. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Installing a drainage system and providing suitable base material minimize the damage to local roads and streets caused by shrinking and swelling and by low strength.

This soil is poorly suited to septic tank absorption fields because of the very slow or slow permeability and the seasonal wetness. Enlarging the field helps to overcome the restricted permeability. Installing perimeter subsurface drains lowers the seasonal high water table. Properly landscaping the absorption field helps to divert surface water away from the field. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4C. The land capability classification is IIIe. The pasture and hayland suitability group is F-5.

WyC2—Wyatt silty clay loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on knolls and hillsides in preglacial valleys. Slopes are typically smooth and uniform. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are irregularly shaped and are 10 to 50 acres in size.

Typically, the surface layer is yellowish brown, friable silty clay loam about 6 inches thick. The subsoil is about 30 inches thick. It is yellowish brown. It is firm silty clay loam in the upper part and mottled, firm, and very firm clay and silty clay in the lower part. The substratum to a depth of about 64 inches is yellowish brown, mottled, very firm, stratified clay and silty clay. In some areas the surface layer is silt loam. In other areas the soil is well drained. In places it has gray mottles directly below the surface layer. In a few areas the subsoil and substratum have less clay.

Included with this soil in mapping are small areas of Doles, Omulga, Richland, and Wilbur soils. Doles and Omulga soils have a fragipan. Doles soils are in intermittent drainageways, and Omulga soils are in the less sloping areas. Richland soils have a higher content of sand and coarse fragments in the subsoil than the Wyatt soil. They are on foot slopes along edges of the valleys. Wilbur soils are on flood plains. They have less clay throughout than the Wyatt soil. Included soils make up about 15 percent of most mapped areas.

Permeability is slow or very slow in the Wyatt soil. The available water capacity is moderate. Runoff is rapid. The subsoil is very strongly acid to medium acid. The shrink-swell potential and the potential for frost action are high. A seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. The organic matter content is moderately low. The root zone is deep.

A few areas are wooded. This soil is moderately well suited to woodland. The species selected for planting should be those that are tolerant of a high clay content in the subsoil. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Some areas are used as cropland. This soil is poorly suited to corn and soybeans. Maintaining stands of deep-rooted legumes is difficult because of the seasonal high water table, the high shrink-swell potential, the high potential for frost action, and acidity in the subsoil. Planting is delayed in some years because the soil dries out slowly in spring. Subsurface drains can lower the seasonal high water table. Crusting of the surface layer after heavy rainfall reduces the rate of water infiltration and hinders seedling emergence. The soil should be tilled only within a limited range of moisture content because it becomes compact and cloddy if it is worked when it is wet and sticky. Cultivated crops can be grown about once every 2 years if erosion is controlled and the soil is otherwise well managed. No-till planting or another system of conservation tillage that leaves crop residue on the surface most of the year, cover crops, grassed waterways, and a cropping sequence that includes grasses and legumes help to control erosion, increase the infiltration rate, minimize surface crusting, and improve tilth.

Most areas are pastured. This soil is moderately well suited to pasture. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. It can be controlled by no-till seeding or by growing a cover crop or companion crop during the establishment of a newly seeded pasture. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer help to control erosion and maintain the stand of key forage species. Frost action may damage legumes. Including fibrous-rooted grasses in the seeding mixture helps to protect the legumes against frost heaving.

This soil is poorly suited to dwellings because of the seasonal wetness and the high shrink-swell potential. It is better suited to dwellings without basements than to dwellings with basements. Reinforcing foundations and footings minimizes the structural damage caused by shrinking and swelling. Backfilling the excavations around walls and foundations with material that has a low shrink-swell potential also minimizes this damage. Backfilling with limestone gravel, using polyethylene sheeting, or applying a protective wall coating around footings minimizes the corrosion of concrete. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Maintaining a protective cover of vegetation or mulch on the site during construction helps to control erosion. Installing an artificial drainage system and providing suitable base material minimize the damage to local roads and streets caused by shrinking and swelling and by low strength.

This soil is poorly suited to septic tank absorption fields because of the very slow or slow permeability and the seasonal wetness. Enlarging the field helps to overcome the restricted permeability. Installing perimeter subsurface drains lowers the seasonal high water table. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface. An aeration sewage disposal system is used in some areas.

The woodland ordination symbol is 4C. The land capability classification is IVe. The pasture and hayland suitability group is F-5.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 62,839 acres in the survey area, or more than 22 percent of the total acreage, meets the soil requirements for prime farmland. The soils in the valley of the Scioto River, in preglacial valley fill areas, on broad ridgetops in the central part of the county, and along secondary streams are dominantly prime farmland. This land is mainly in associations 5, 6, and 7, which are described under the heading "General Soil Map Units." Most of the prime farmland is used for crops.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

The soils in the survey area are assigned to various interpretative groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

Daryl Shoemaker, county agent, Cooperative Extension Service, helped prepare this section.

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

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

More than 87,000 acres in the survey area was used for crops and pasture in 1984 *(22)*. Of this, about 28,000 acres was used for row crops, mainly corn and soybeans; 2,700 acres for close-growing crops, mainly wheat; 11,000 acres for hay; 3,600 acres for rotation hay and pasture; and 38,000 acres for permanent pasture. The rest was idle cropland and pasture.

The potential of the soils in Pike County for grain crops and pasture is good. Production can be increased by using the information in this survey and by applying the latest production techniques. Some of the acreage that commonly is pastured or wooded has good potential for grain crops. The feasibility of converting areas of pasture to grain production and wooded areas to pasture or cropland would depend on economic and environmental considerations.

The acreage used for crops and pasture in Pike County has not been greatly changed by urban development. Approximately 8,900 acres in the county is urban and built-up land *(22)*. This figure has increased by about 700 acres since 1967 *(20)*.

In the paragraphs that follow, the major management needs on the cropland and pasture in the county are described. These needs are measures that control erosion, reduce wetness, and maintain fertility and tilth.

Erosion is a major problem on about 45 percent of the cropland and 88 percent of the pasture in the county. Even in nearly level areas, erosion can reduce productivity or interfere with fieldwork. In areas where the slope is more than 3 percent, special conservation practices are needed to hold erosion losses within limits that will not reduce productivity or increase production costs. Productivity is reduced if the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer results in poor tilth in soils that have a clayey subsoil, such as Rarden and Wyatt soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Fox and Gilpin soils, because it reduces the available water capacity of the soils.

Erosion increases the cost of production because many of the plant nutrients added to the soil in commercial fertilizers or in organic matter are held by the soil particles in the surface layer. Erosion removes these plant nutrients along with the soil particles.

Erosion also results in the pollution of streams by sediment and nutrients. Controlling erosion minimizes this pollution and improves water quality for municipal use, for recreation, and for fish and wildlife.

On the more eroded spots in many gently sloping and strongly sloping fields, tilling and preparing a good seedbed are difficult because most of the original surface layer has been lost. The impaired seed-soil contact and reduced available water capacity in these spots result in poor stands. These spots are common in areas of the eroded Markland and Wyatt soils and in areas of Coolville and Omulga soils.

Erosion-control measures commonly provide a protective surface cover, reduce the runoff rate, and increase the rate of water infiltration. Contour farming, contour stripcropping, and terraces are effective in controlling erosion. In most areas of the county, however, slopes are too short and too irregular for these measures to be practical.

A cropping system that keeps a plant cover on the surface for extended periods can hold soil losses to amounts that do not reduce the productive capacity of the soils. On livestock farms, where pasture and hay are grown in rotation with grain crops, including grasses and legumes in the cropping sequence helps to control erosion, provides nitrogen, and improves tilth.

No-till planting or another system of conservation tillage that leaves crop residue on the surface increases the rate of water infiltration and reduces the hazards of runoff and erosion (fig. 9). Conservation tillage is suitable on most of the soils in the county. Unless they are drained, somewhat poorly drained to very poorly drained soils are not so well suited to no-till farming as well drained and moderately well drained soils.

Grassed waterways reduce the hazard of erosion by slowing runoff to a nonerosive velocity. Natural drainageways are the best sites for grassed waterways. They generally require minimal shaping when a good channel is designed. Channels should be wide and flat so that they can be easily crossed by farm machinery. Many areas where surface runoff concentrates into a narrow channel or where it flows across the steeper slopes can be protected by a grassed waterway.

Information about the design of erosion-control practices for each kind of soil is available at the local office of the Soil Conservation Service. Current information about tillage practices is available at the local offices of the Soil Conservation Service and Cooperative Extension Service.

Drainage is a management concern on nearly 8 percent of the acreage in the county. The very poorly drained and poorly drained Melvin, Montgomery Variant, and Peoga soils are so wet that yields are reduced in most years unless a drainage system is installed. Small depressional areas of these soils are subject to ponding. Surface drains are needed to control ponding.

The somewhat poorly drained Doles, McGary, Orrville, Stendal, and Taggart soils dry out and warm up slowly in spring unless they are drained. Wetness delays planting and germination and reduces yields. In many years excess moisture in the root zone damages crops.

A drainage system also is needed on the nearly level Omulga and Otwell soils and on the nearly level and gently sloping Tilsit soils. These soils have a fragipan.

The design of both surface and subsurface drainage systems varies with the kind of soil and the availability of outlets. Drains should be spaced closer together in the slowly permeable soils than in the more permeable soils. Finding adequate outlets is difficult in many areas.

Information about the designs of drainage systems for each kind of soil is available in the local office of the Soil Conservation Service.

Fertility is naturally low in most of the upland and old terrace soils in the county. These soils are naturally acid and require applications of lime to raise the pH level enough for legumes and other crops to grow well. The supply of available phosphorus and potassium is naturally low in many of these soil. Genesee and Huntington soils, which are on flood plains, are slightly

Figure 9.—No-till corn on Omulga silt loam, 3 to 8 percent slopes.

acid to mildly alkaline or are moderately alkaline in the root zone. These soils have a naturally higher content of plant nutrients than most of the soils in the uplands. Applications of lime and fertilizer on all soils should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can be of assistance in determining the kind and amount of fertilizer and lime needed.

Tilth is an important factor affecting the germination of seeds and the infiltration of water. Soils with good tilth are friable and porous. Maintaining tilth is a concern in many of the soils in Pike County.

The surface layer of most soils in the county is light colored silt loam with a moderately low organic matter content. This layer tends to crust after periods of heavy rainfall. The crust is hard when dry and nearly impervious to water. It reduces the infiltration rate and increases the runoff rate and the hazard of erosion. If these soils are plowed by a moldboard in the fall, the surface tends to crust in winter and early spring. Consequently, the plow layer is nearly as dense and hard in the spring as it was before it was plowed in the fall. Regular additions of crop residue, manure, and other organic material are needed to maintain good soil structure and minimize crusting.

Field crops suited to the soils and climate of Pike County include many that are not commonly grown. Corn and soybeans are the main row crops. Grain sorghum, sunflowers, navy beans and similar crops could be grown if economic conditions were favorable. Wheat is the most common close-grown crop. Oats, rye, barley, and flax also could be grown. Seed could be produced from fescue, timothy, and bluegrass and from red clover, alsike clover, and alfalfa.

Specialty crops are grown in some areas of the county. Tobacco is the chief specialty crop. It grows best on deep, well drained soils, such as Clifty and Elkinsville soils. Growing tobacco year after year tends to deplete natural fertility and break down soil structure. This crop should be grown in rotation with other crops and should not be planted more than once in 3 years in the same field.

Strawberries, tomatoes, sweet corn, melons, potatoes, orchards, and vineyards could be grown more extensively. Soils that are well drained and warm up early in spring, such as the Fox soils that have a slope of less than 6 percent, are especially well suited to many vegetable and small fruit crops. The crops can generally be planted and harvested earlier on these soils than on other soils.

The latest information about growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Pasture and hayland make up approximately 18 percent of the acreage in Pike County. Another 8 percent of the acreage is potential pasture or hayland that is presently idle and reverting to brush and young trees *(22)*. Most of the soils used as pasture and hayland are on hillsides adjacent to cultivated areas on the less sloping parts of the landscape (fig. 10). They formed in material weathered from shale, siltstone, or sandstone. These soils are susceptible to erosion. The pasture and hayland generally support bluegrass and tall grasses, such as tall fescue, orchardgrass, and timothy. Many pastures are unimproved and require renovation and brush control.

Overgrazing results in fields of weedy, low-producing forage and in a hazard of increased erosion because of the sparse, short vegetative cover. Soils in these fields frequently are acid and have low levels of phosphorus and potassium. Good management can restore the productivity of the pasture.

Successful establishment of forage crops requires the selection of species and varieties adapted to the soils. If the pasture is reseeded, proper seedbed preparation, proper seeding methods and seeding times, and recommended applications of lime and fertilizer are needed. Forage renovation requires that the existing grasses and weeds be removed before the pasture is reseeded to the desired species. Removing the existing sod and leaving it on or near the surface as mulch reduce the erosion hazard. Nearly level pastures can be plowed. In gently sloping and strongly sloping areas, the pasture should be tilled and seeded on the contour.

No-till seeding is effective on most of the soils in Pike County, except for the wetter soils. Before this seeding method is applied, vegetation should be removed by grazing or by applications of herbicide.

April and August are usually the best times for forage seedings. The forage can be seeded with a small grain crop. Because of plant competition for light, moisture, and nutrients, however, this method of seeding results in reduced forage stands.

Seeding mixtures should be based on soil characteristics and the desired pasture management system. Mixtures of grasses and legumes have a higher nutrient value than grasses alone. Legumes also provide nitrogen for improved grass growth. Alfalfa and red clover should be seeded on well drained soils. Ladino clover and alsike clover grow best on the wetter soils. Birdsfoot trefoil, bromegrass, lespedeza, warm-season grasses, and vetches are generally not grown as forage species in Pike County, but they could be successfully included in a forage management system.

Applying lime and fertilizer according to the results of soil tests ensures good productivity and lengthens the life of the stand. Weed control by mowing, clipping, and spraying is important for continued high production. Timely mowing is needed. Control of insects, such as alfalfa weevil and potato leafhopper, may be needed.

Harvesting hay or silage and grazing forage species at the proper stage of maturity results in the maximum nutritional value. The most current agronomy guide indicates the proper management of the forage species on a given farm *(11)*.

Figure 10.—Pasture and hayland in an area of Omulga and Rarden soils. Omulga soils are in the valley, and Rarden soils are on the hillsides.

Table 7 can be used by farmers, farm managers, conservationists, and extension agents in planning the use of the soil for pasture and hay crops. Soils that have a slope of more than 25 percent are generally not suitable for pasture or hayland.

The table lists the pasture and hayland suitability group symbol for each soil. Soils assigned the same suitability group symbol require the same general management and have about the same potential productivity. The pasture and hayland suitability groups are based on soil characteristics and limitations.

Soils assigned to group A generally have few limitations affecting the management and growth of climatically adapted plants. Those in group A-1 are deep and well drained. They have a surface layer of loam or fine sandy loam. The available water capacity is low or moderate. Slopes range from 0 to 15 percent. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil can shorten the life of some deep-rooted legumes in the stand.

Soils in group A-2 are deep and are well drained or moderately well drained. They have a surface layer of clay loam, fine sandy loam, loam, or silt loam. The available water capacity is moderate. Slopes range from 15 to 30 percent. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil can shorten the life of some deep-rooted legumes in the stand. The slope limits the mechanical application of lime and fertilizer. It also limits clipping, mowing, and spraying for weed control. Erosion is a hazard if the pasture is overgrazed or cultivated for reseeding. These soils are suited to no-till reseeding and to interseeding.

Soils in group A-3 are deep and well drained. They have a surface layer of channery fine sandy loam, loam, channery silt loam, or silt loam. The available water capacity is moderate. Slopes range from 25 to 40 percent. As a result, these soils are generally not suitable for pasture or hayland.

Soils in group A-5 are deep and are well drained or moderately well drained. They are on flood plains. Occasional flooding is a hazard. The deposition of sediment by floodwater lowers the quality of the forage. These soils have a surface layer of loam or silt loam. The available water capacity is low to very high. Slopes are 0 to 2 percent.

Soils in group A-6 are deep, are well drained or moderately well drained, and are subject to frost action, which can damage legumes. Including fibrous-rooted grasses with the legumes in seeding mixtures and applying proper grazing management minimize the damage caused by frost action. The surface layer of these soils is silt loam. The available water capacity is moderate or high. Slopes range from 0 to 25 percent.

Soils in group B are limited by droughtiness. Those in group B-1 are deep and well drained. They have a surface layer of gravelly loam and a high content of coarse fragments in the substratum. The available water capacity is moderate. Slopes range from 0 to 8 percent. These droughty soils are suited to warm-season grasses, such as switchgrass, big bluestem, indiangrass, and Caucasian bluestem. They have a moderately deep root zone. As a result, forage species that do not have a taproot system grow better than other species. Plants on these soils respond favorably to applications of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil can shorten the life of some deep-rooted legumes in the stand.

Soils in group B-2 are deep and well drained. They have a surface layer of channery silt loam. The available water capacity is low. Slopes range from 25 to 40 percent. This group is generally not suitable for pasture or hayland.

Soils in group C have a seasonal high water table. Those in group C-1 are deep and somewhat poorly drained. They have a surface layer of silt loam. The available water capacity is high. Slopes range from 0 to 4 percent. Frost action may damage legumes. Including fibrous-rooted grasses in seeding mixtures and applying proper grazing management can minimize the damage caused by frost heaving. A seasonal high water table limits the rooting depth of forage plants. Shallow-rooted species grow best on these soils. Subsurface drains lower the seasonal high water table. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes in the stand.

Soils in group C-2 are deep and are somewhat poorly drained or poorly drained. They have a surface layer of silt loam. The available water capacity ranges from low to high. Slopes range from 0 to 4 percent. A seasonal high water table limits the rooting depth of forage plants. Some of the soils have a fragipan, which also restricts the rooting depth. Shallow-rooted species grow best on these soils. Subsurface drains lower the seasonal high water table. Restricted permeability in the subsoil or unfavorable landscape positions limit the effectiveness of subsurface drainage systems.

Soils in group C-3 are deep and are somewhat poorly drained to very poorly drained. They are on flood plains. Frequent or occasional flooding is a hazard. The deposition of sediment by floodwater lowers the quality of the forage. The surface layer of these soils is silt loam. The available water capacity is high or very high. Slopes range from 0 to 2 percent. Frost action may damage legumes. Including grasses in seeding mixtures and applying proper grazing management minimize the damage caused by frost heaving. A seasonal high water table limits the rooting depth of forage plants. Shallow-rooted species grow best on these soils. Subsurface drains lower the water table. The effectiveness of subsurface drains is limited by the landscape position of the soils.

Soils in group E are shallow. The root zone in these soils extends to a depth of 10 to 20 inches. The soils are better suited to forage species that have a fibrous root system than to deep-rooted species. Soils in group E-1 are well drained. They have a surface layer of silt loam. The available water capacity is very low. Slopes range from 8 to 30 percent. These droughty soils are suited to warm-season grasses, such as switchgrass, big bluestem, indiangrass, and Caucasian bluestem.

Soils in group F have a root zone that extends to a depth of 20 to 40 inches. They are better suited to forage species that do not have a taproot system than to other species.

Soils in group F-1 are moderately deep and are well drained and moderately well drained. They have a surface layer of channery silt loam or silt loam. The available water capacity is very low to moderate. Slopes range from 3 to 25 percent. These droughty soils are well suited to warm-season grasses, such as switchgrass, big bluestem, indiangrass, and Caucasian bluestem. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes in the stand.

Soils in group F-2 are moderately deep, steep, and well drained and moderately well drained. They have a surface layer of silt loam. The available water capacity is low. Slopes range from 25 to 40 percent. This group is generally not suitable for pasture or hayland.

Soils in group F-3 are deep, are moderately well drained, and have a fragipan. The surface layer is silt loam. The available water capacity is low in the root zone. Slopes range from 0 to 15 percent. These soils have a restricted root zone. As a result, they are better suited to forage species that do not have a taproot system than to other species. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes in the stand.

Soils in group F-5 are deep, are moderately well drained and well drained, and have a high content of clay in the subsoil. The content of clay restricts the rooting depth. The surface layer of these soils is silty clay loam. The available water capacity is moderate. Slopes range from 3 to 25 percent. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH in the subsoil shortens the life of some deep-rooted legumes in the stand.

Recommended species or forage mixtures for seeding are shown in table 7. The yields given are those that can be expected under a high level of management. They may vary in any given year because of seasonal rainfall and other climatic factors. Grass yields are dependent on an adequate supply of nitrogen. The indicated yields cannot be achieved without applications of nitrogen fertilizer.

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 tables 6 and 7. In any given year, yields may be higher or lower than those indicated in the tables because of variations in rainfall and other climatic factors. The land capability classification and pasture and hayland suitability group of each map unit also are shown in the tables.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

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

Crops other than those shown in tables 6 and 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(19)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

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

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 8. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in table 6.

Woodland Management and Productivity

L.A. Crocker, service forester, Ohio Department of Natural Resources, Division of Forestry and Foresters, and the Woodland Department of the Mead Paper Company helped prepare this section.

Woodland is a major land use in Pike County. It makes up about 63 percent of the total acreage *(23)*. About 140,000 acres or 80 percent of the woodland, is privately owned and is in tracts of various sizes. About 26,000 acres of woodland is owned and managed by a large wood-using industry.

Pike State Forest is located in the northwestern part of Pike County. Land aquisition for this forest began in 1924. The objective was to convert mismanaged farms and fire-damaged land to productive forests. Many of the old fields were planted in the 1930's by the Civilian Conservation Corps and the Ohio Department of Natural Resources, Division of Forestry. The forest is managed under the multiple-use concept. It provides timber, wildlife habitat, and recreational opportunities. Planned activities, such as forest protection and reforestation, preserve esthetic value, help to control erosion, and protect watersheds. The effects of harvesting on wildlife, recreation, esthetic values, and watersheds are evaluated. Timber is harvested only after the trees are inspected and marked. The products obtained from harvesting, timber stand improvement, and thinning include sawlogs, veneer logs, posts, pulpwood, and firewood. A detailed forest management plan is used to help foresters determine which management practices are needed.

Generally, the woodland throughout the county supports mixed hardwoods dominated by oak, hickory, yellow-poplar, and maple. Most of the wooded acreage is in areas of soils that formed in residuum and colluvium derived from sandstone, siltstone, and shale on narrow ridgetops and steep side slopes. Most broad ridgetops, high terraces, and foot slopes have small wooded tracts. Flood plains and slack-water terraces are almost exclusively farmed and have very few wooded areas. Some idle pasture and steep cropland is reverting to woodland.

Much of the woodland demonstrates the outcome of poor management. Poor harvesting techniques have removed the best timber and left the diseased, damaged, and low-value trees on many of the good woodland sites. Poor logging practices have resulted in severe erosion in some areas, especially in the steeper areas. Many clear-cut areas on south aspects revegetate very slowly. Grazing by livestock damages trees, causing a decaying fungus at the base of the trunks. It also results in soil compaction, an increased seedling mortality rate, and a loss of ground cover, which increases the susceptibility to erosion. Good management can restore these areas to a higher level of production.

Soils differ greatly in their productivity for woodland. The factors that influence tree growth are essentially the same as those that affect annual crops and pasture.

The available water capacity has very important effects on tree growth. It is influenced by soil depth, texture, permeability, and internal drainage. The aspect and position of the soil on the landscape are also important factors. Slope, acidity, fertility, and degree of past erosion are other factors that influence woodland productivity.

The aspect is the compass direction in which a slope faces. North aspects are those slopes that have an azimuth of 355 to 95 degrees *(4)*. South aspects have an azimuth of 96 to 354 degrees. Trees grow better on north aspects, which are less exposed to the prevailing winds and to direct sunrays and thus have more soil moisture. South aspects are less well suited to trees because soil temperatures are higher, snow melts earlier, the soil is subject to more freezing and thawing, and the prevailing winds increase the evaporation rate.

The position of the soil on the landscape is important in determining the amount of moisture available for tree growth. The supply of soil moisture commonly increases as elevation on a slope decreases. The lower part of the slope generally has deeper soils, more moisture available to plants, less evaporation, and lower soil temperatures.

Slope is another important management factor. A steep slope can seriously limit equipment use. In the steeper areas, the rate of water infiltration is reduced, runoff is more rapid, and erosion is a severe hazard.

Soil reaction and fertility influence tree growth. For example, black walnut trees grow better on Huntington, Genesee, and other soils that have a higher level of lime in the root zone than other soils. Growth is slower on the less fertile soils.

Erosion reduces the available water capacity of the soil. Severe erosion removes the topsoil and commonly exposes the less porous, less fertile subsoil, thus increasing the runoff rate and reducing the water intake rate. Both tree growth and natural regeneration are adversely affected. Erosion occurs during periods of heavy rainfall, when the soil is saturated. Because the intake rate is slow, water flows across the surface and removes soil particles.

Grazing by livestock and overuse of recreational areas destroy the forest litter, reduce the rate of water infiltration, and increase the hazard of erosion. Harvesting activities can cause erosion. Transporting logs from the stump to the skid trails and haul roads, for example, can cause severe erosion. About 99 percent of the sediments in the woodlands of the Northeast originates on skid trails and logging roads *(6)*. Much of the stream sediment also originates on these trails and roads. Because the roads are compacted, runoff carries away tons of soil, often creating gullies. Sediment deposition often occurs in nearby watercourses.

The hazard of erosion can be reduced by good water-control techniques. Building logging roads across the slope helps to control erosion. Selecting the better drained, less sloping soils as sites for log landings also helps to control erosion and facilitate the use of equipment (fig. 11). Spreading gravel or crushed stone in eroded areas helps to prevent gullying. Filter or buffer strips between the harvest site and streams can help to trap sediment. Both intermittent and perennial streams should be protected. Water breaks or water bars, culverts, and dips in the road that divert water into a stable outlet help to control erosion on all road grades (fig. 12). Culverts, bridges, and gravel can be used at stream crossings and at the entrance to the harvest site from a public road. Use of haul roads during wet periods should be restricted. Grasses should be planted on log landings and spoil banks.

The forestland in the county provides a variety of benefits, such as timber products, wildlife habitat, watershed protection, and opportunities for recreation. The timber products include lumber, veneer, pulpwood, barrel staves, railroad ties, firewood, and fenceposts. Proper management of private woodland is the key to future wood production in Pike County.

The goal of timber management is to produce high-quality trees in a short period by regulating the density and composition of the stand through timber harvesting, timber stand improvement, and tree planting. There are two general types of forest stands, even-aged and uneven-aged. An even-aged stand consists of trees of the same age class. The dominant trees generally are uniform in height, although trunk diameters may vary greatly. An uneven-aged stand consists of trees of many different heights and diameters. The type of harvest and regeneration method in the future will maintain or change the composition of the stand.

The harvest method must be suited to the landowner's objectives and the species within the timber stand. Harvesting creates a suitable environment for natural regeneration. The landowner should be careful when selecting a harvesting method. The number, size, and species of the trees removed will determine the quality and productivity of the woodland for many years. Common types of harvesting in the county are clear-cutting, single-tree selection, and group selection.

The clear-cut method removes the entire stand of trees in one cutting. After the harvest, regeneration will create a new even-aged stand. The new trees will grow from existing seedlings, root and stump sprouts, and

Figure 11.—A log landing in an area of Markland silty clay loam, 8 to 15 percent slopes, eroded.

seeds from harvested or adjacent trees. The clear-cut method favors tree species that require some sunlight to reproduce, such as yellow-poplar, black cherry, red maple, and quaking aspen. The size and shape of the cut should be based on the landowner's objectives and the size of the wooded tract. Research indicates that clear-cutting Appalachian hardwoods results in the largest number of new seedlings *(13)*.

Where the single-tree selection method is used, trees are harvested on an individual basis. Single trees are harvested as they become mature. The number cut is frequently based on the growth that will occur before the next harvest. This method of harvesting produces an uneven-aged stand. It favors sugar maple, American beech, and other trees that thrive and reproduce in shaded areas. It maintains a continuous stand of trees.

Where the group selection method is used, small groups of trees are harvested together. This method creates openings that are similar to small clear-cut areas. Harvesting groups of trees allows additional sunlight to reach the forest floor and favors species that need sunlight to reproduce. The overall stand is uneven-aged. This method maintains a continuous stand of trees and allows for reproduction of some species that are not tolerant of shade.

Timber stand improvement includes many different forestry practices. Thinning, weeding, firewood cutting, grapevine control, and pruning are all timber stand improvement measures. These measures improve the growth rates and quality of a stand of trees. They are needed in many wooded areas throughout the county. Under two programs, the federal government shares the cost of timber stand improvement with the landowner. These programs are administered by the United States Department of Agriculture, Agricultural Stabilization and Conservation Service.

Tree planting not only provides future wood products but also improves wildlife habitat. The county has many areas that could benefit from tree planting. These include small, idle or abandoned fields and areas with steep slopes. The species selected for planting and the spacing between the trees should be based on the future products desired and on the individual site and soil requirements.

The county has only a few Christmas tree farms. Christmas tree production is suitable in many areas. Most of these areas are presently idle. The most commonly planted Christmas tree species are Scotch

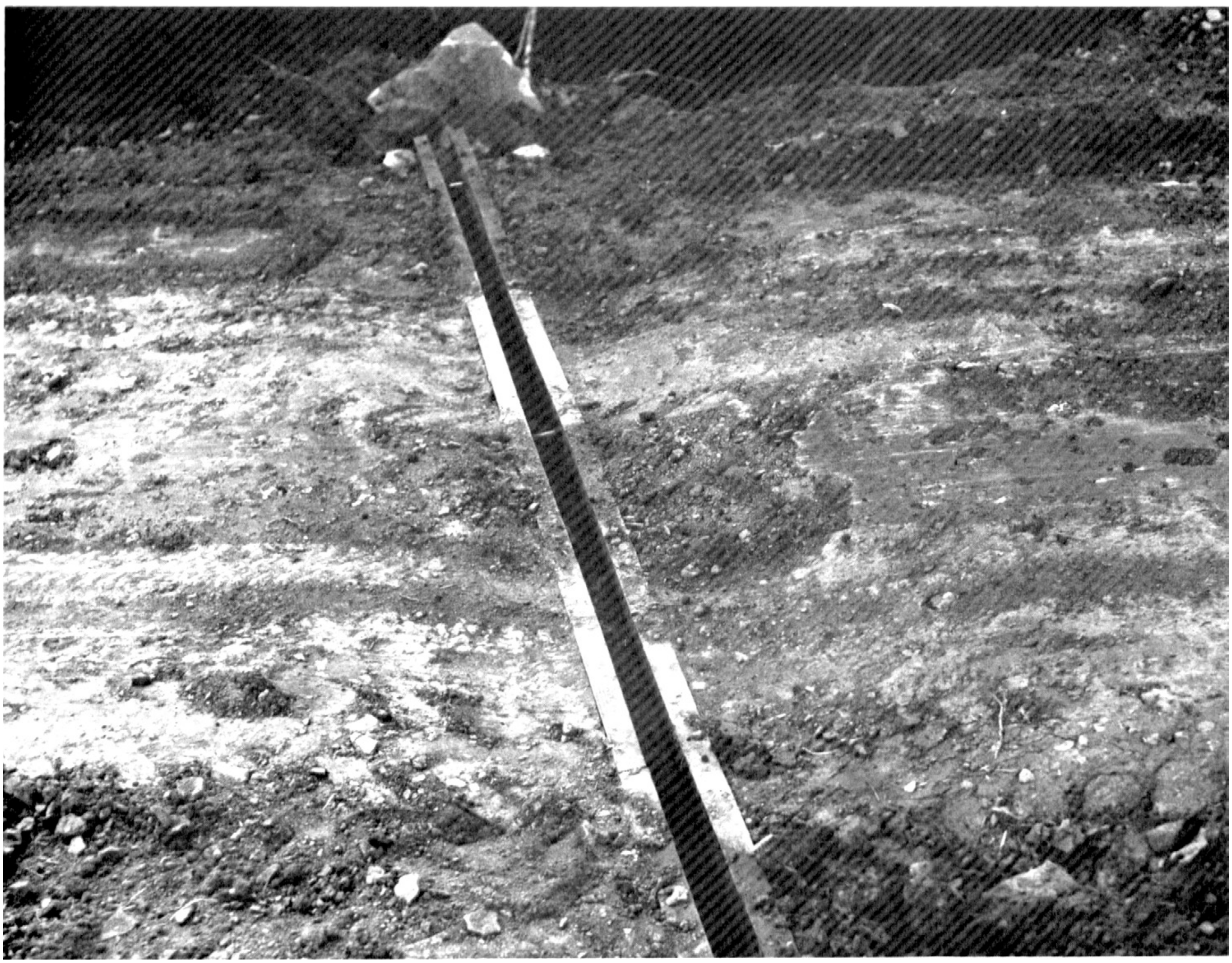

Figure 12.—A box open-top culvert installed across a logging road in an area of the Shelocta-Brownsville association, steep. Culverts help to control erosion.

pine and white pine. These species reach a height of 6 to 7 feet in 6 to 9 years. Several management techniques, such as shearing, mowing, or spraying, are needed to produce high-quality trees. The trees must be protected against insects, diseases, and the damage caused by animals.

The Division of Forestry, Ohio Department of Natural Resources, provides service foresters to assist private landowners with woodland management.

Table 9 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 9, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

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

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

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

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from a commercial nursery or from local offices of the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Forestry; or the Cooperative Extension Service.

Recreation

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

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

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

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

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

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Jim Borchelt, district conservationist, Soil Conservation Service, helped prepare this section.

Wildlife is one of the major natural resources in Pike County. The most common species are white-tailed deer, ruffed grouse, turkey, gray squirrel, furbearing mammals, cottontail rabbit, bobwhite quail, a wide variety of songbirds, birds of prey, numerous fish species, and lower food chain members, such as rodents, reptiles, and amphibians. The abundance of a species is determined mainly by the amount of suitable habitat available to the species.

The soils of Pike County are suited to the development of wildlife habitat. Erosion should be controlled and vegetation and water should be managed so that it meets the needs of each species. Well managed field borders, fence rows, hedgerows, ditch berms, ponds, woodlots, cropland, hayland, and reverting fields of grasses and brush are all used as wildlife habitat.

Where food, water, or cover is lacking or in short supply, the habitat can be improved by planting food patches, evergreen trees, or fruit-bearing shrubs; leaving crop residue on the surface throughout the winter; building brush piles; managing ponds for wildlife; erecting nest boxes; clear-cutting quarter of an acre plots and strips in woodlands when trees are harvested or cut for firewood; and delaying the cutting of hay until after the peak of the nesting season. Establishing 20-foot-wide grass strips and cutting back woodland borders 40 feet also improve the habitat.

In some areas the most suitable land use is wildlife habitat because of the soil type, the landscape position, or economic factors. For example, many areas of steep soils used as woodland are best suited to woodland wildlife habitat and to recreational uses.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

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

The potential of the soil is rated good, fair, poor, or very poor *(1)*. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, ragweed, and fescue.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, maple, hawthorn, dogwood, hickory, blackberry, and black walnut. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, duckweed, reed canarygrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl-feeding areas, and shallow ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, groundhog, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

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

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble

Figure 13.—A farm pond in an area of Rarden silt loam, 15 to 25 percent slopes.

salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment (fig. 13). Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 20.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

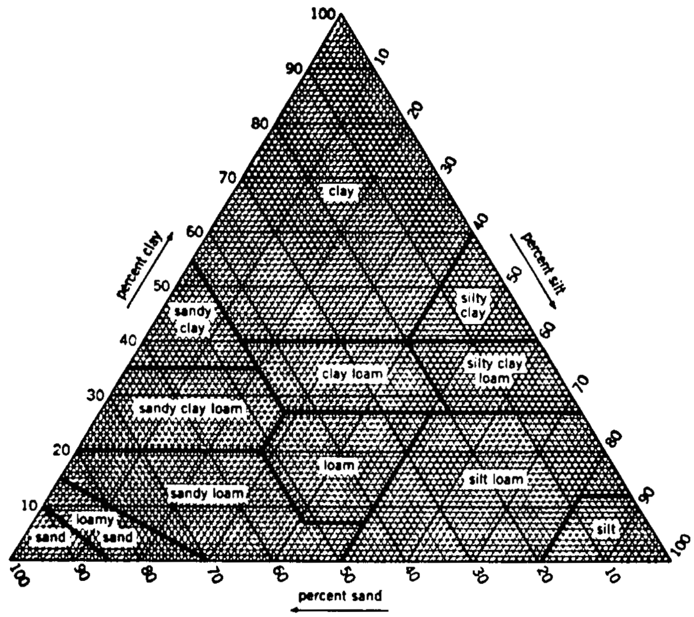

Figure 14.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 14). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(3)* and the system adopted by the American Association of State Highway and Transportation Officials *(2)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested is given in table 20.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

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

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

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

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

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

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

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to two hydrologic groups in table 19, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, 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 the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

Many of the soils in Pike County were sampled by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained from most of the samples include particle-size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in classifying and correlating the soils and in evaluating their behavior under various land uses. Seven pedons were selected as representative of their respective series and are described in the section "Soil Series and Their Morphology." The names of these series and their laboratory identification numbers are: Coolville (PK-3), Wyatt (PK-8), Doles (PK-9), Taggart (PK-10), Shelocta (PK-11), Latham (PK-12), and Tilsit (PK-13).

In addition to the data from Pike County, laboratory data also are available from nearby counties in southern Ohio. These data and the data from Pike County are on file at the Department of Agronomy, Ohio State University; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Soil Conservation Service, State Office, Columbus, Ohio.

Engineering Index Test Data

Table 20 shows laboratory test data for three pedons sampled at carefully selected sites in the survey area. The pedons are representative of the Doles, Shelocta, and Taggart series, which are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(21)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 21 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludults (*Hapl*, meaning minimal horizonation, plus *udult*, the suborder of the Ultisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludults.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (18)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (21)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Allegheny Variant

The Allegheny Variant consists of deep, well drained soils formed in old alluvium on hillsides along drainageways in preglacial valleys. Permeability is moderate in the upper part of the profile and moderately rapid or rapid in the lower part. Slopes range from 15 to 25 percent.

Allegheny soils are commonly adjacent to Melvin, Omulga, Stendal, and Wyatt soils. The poorly drained Melvin and somewhat poorly drained Standal soils are on flood plains. They have more silt and less sand in the subsoil than the Allegheny Variant soils. Omulga and Wyatt soils are on flats and side slopes in preglacial valleys. Omulga soils have a fragipan. Wyatt soils have more clay and less sand in the subsoil than the Allegheny Variant soils.

Typical pedon of Allegheny Variant loam, 15 to 25 percent slopes, 0.75 mile southeast of Givens, in Beaver Township; about 700 feet west and 1,180 feet north of the southeast corner of sec. 33, T. 5 N., R. 21 W.

Oe—1 inch to 0; partially decomposed mixed hardwood leaf litter.

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many medium roots; strongly acid; abrupt smooth boundary.

A2—1 to 10 inches; brown (10YR 5/3) loam, light gray (10YR 7/2) dry; weak fine granular structure; friable; many medium roots; few fine vesicular pores; strongly acid; clear smooth boundary.

AE—10 to 18 inches; brown (10YR 4/3) loam, very pale brown (10YR 7/3) dry; weak medium granular structure; friable; many medium roots; few fine vesicular pores; very strongly acid; clear wavy boundary.

Bt1—18 to 25 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; firm; common medium roots; few fine vesicular pores; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; few prominent brown (10YR 5/3) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt2—25 to 34 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; many distinct yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

BC—34 to 44 inches; strong brown (7.5YR 5/6) loamy sand; common medium distinct yellowish brown (10YR 5/6) and common coarse distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; very strongly acid; diffuse wavy boundary.

C—44 to 63 inches; strong brown (7.5YR 5/8) loamy sand; few coarse distinct yellowish brown (10YR 5/4) mottles; single grained; loose; about 2 percent gravel; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The content of coarse fragments ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. It is loam or sandy loam. The C horizon has colors similar to those of the Bt horizon. It is sand, loamy sand, or loam.

Blairton Series

The Blairton series consists of moderately deep, moderately well drained, moderately slowly permeable soils. These soils formed in colluvium and residuum derived from sandstone, siltstone, and shale on ridgetops and shoulder slopes in the uplands. Slopes range from 5 to 20 percent.

Blairton soils are commonly adjacent to Brownsville, Coolville, Gilpin, and Rarden soils and are similar to Gilpin and Wharton soils. Brownsville, Coolville, and Wharton soils are deep over bedrock. Brownsville soils are on hillsides. Coolville soils are in landscape positions similar to those of the Blairton soils. Gilpin and Rarden soils are on ridgetops and hillsides. Gilpin soils are well drained. Rarden soils have more clay in the subsoil than the Blairton soils.

Typical pedon of Blairton silt loam, in an area of Blairton-Rarden-Gilpin association, rolling; about 5 miles east of Omega, in Jackson Township; 400 feet east and 200 feet south of the center of sec. 30, T. 7 N., R. 20 W.

Oe—2 inches to 0; partially decomposed pine needles and mixed hardwood leaf litter.

A—0 to 1 inch; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; very friable; many fine roots; about 2 percent coarse fragments; strongly acid; clear smooth boundary.

E—1 to 5 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common medium roots; few fine vesicular pores; about 2 percent coarse fragments; strongly acid; gradual wavy boundary.

Bt1—5 to 13 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; common distinct brown (7.5YR 4/4) clay films on faces of peds; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—13 to 21 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

Bt3—21 to 34 inches; yellowish brown (10YR 5/6) channery silty clay loam; common fine prominent light gray (10YR 7/1), common medium faint yellowish brown (10YR 5/8), and few fine prominent reddish brown (5YR 5/4) mottles; weak medium subangular blocky structure; very firm; few fine vesicular pores; many prominent light gray (10YR 7/1) clay films on faces of peds; about 25 percent coarse fragments; strongly acid; gradual smooth boundary.

BC—34 to 40 inches; strong brown (7.5YR 5/6) channery silty clay loam; few fine prominent reddish brown (5YR 5/4) and common medium prominent pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; very firm; about 15 percent coarse fragments; strongly acid; abrupt smooth boundary.

R—40 to 44 inches; strong brown (7.5YR 5/6), yellowish brown (10YR 5/4), and light gray (10YR 7/2), soft siltstone.

The depth to bedrock and the thickness of the solum range from 20 to 40 inches. The content of coarse fragments ranges from 2 to 15 percent in the A horizon and from 5 to 35 percent in the Bt horizon.

The A horizon has chroma of 2 to 4. The B horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 6. It is silt loam, silty clay loam, or the channery analogs of those textures.

Bratton Series

The Bratton series consists of moderately deep, well drained soils on undulating ridgetops and shoulder slopes in the uplands. These soils formed in loess and in the underlying material weathered from dolomitic limestone. Permeability is moderately slow in the upper part of the profile and rapid directly above the bedrock. Slopes range from 3 to 15 percent.

Bratton soils are commonly adjacent to Latham, Opequon, and Trappist soils. Latham and Trappist soils are more acid in the lower part than the Bratton soils. Latham soils are on ridgetops and hillsides. Trappist soils are on hillsides. Opcquon soils are shallow over dolomitic limestone bedrock. They are on shoulder slopes and on dissected side slopes along drainageways.

Typical pedon of Bratton silt loam, 3 to 8 percent slopes, eroded, about 1.25 miles southeast of Sinking Spring, in Mifflin Township; 1,650 feet south-southeast of the intersection of State Route 124 and Nace Corner Road, along Nace Corner Road, then 2,445 feet southwest:

Ap—0 to 5 inches; dark brown (7.5YR 4/4) silt loam, light brown (7.5YR 6/4) dry; moderate coarse granular structure; friable; many fine roots; medium continuous dark brown (7.5YR 3/2) organic coatings on faces of peds; medium acid; abrupt smooth boundary.

Bt1—5 to 14 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; common fine roots; few fine vesicular pores; many faint reddish brown (5YR 4/4) clay films on faces of peds; many coarse black (N 2/0) concretions and stains (iron and manganese oxide); slightly acid; clear wavy boundary.

2Bt2—14 to 21 inches; yellowish red (5YR 4/6) silty clay; moderate medium prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; few fine vesicular pores; many distinct reddish brown (5YR 4/4) clay films on faces of peds; few fine black (N 2/0) concretions; many medium black (N 2/0) stains (iron and manganese oxide); about 2 percent coarse fragments; medium acid; gradual wavy boundary.

2Bt3—21 to 27 inches; yellowish red (5YR 5/6) clay; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; few very fine vesicular pores; many distinct reddish brown (5YR 4/4) clay films on faces of peds; few fine black (N 2/0) stains (iron and manganese oxide); about 2 percent coarse fragments; slightly acid; clear wavy boundary.

2Bt4—27 to 36 inches; reddish brown (5YR 4/4) clay; moderate medium subangular blocky structure; firm; few very fine roots; few very fine vesicular pores; many distinct dark reddish brown (5YR 3/4) clay films on faces of peds; about 2 percent coarse fragments; neutral; abrupt wavy boundary.

2C—36 to 38 inches; light yellowish brown (10YR 6/4) channery fine sandy loam; common medium faint yellowish brown (10YR 5/4) mottles; massive; loose;

about 20 percent limestone fragments; slight effervescence; mildly alkaline; abrupt smooth boundary.

2R—38 to 42 inches; hard, massive, dolomitic limestone.

The thickness of the solum ranges from 20 to 38 inches. The depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments is 0 to 10 percent in the solum.

The Ap horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. The 2Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay or clay. The 2C horizon has hue of 10YR or 7.5YR and chroma of 3 or 4. It is loamy sand, sandy loam, fine sandy loam, or the channery analogs of those textures.

Brownsville Series

The Brownsville series consists of deep, well drained soils formed in colluvium and residuum derived from fine grained sandstone and siltstone on hillsides in the uplands. Permeability is moderate or moderately rapid. Slopes range from 25 to 40 percent.

Brownsville soils are commonly adjacent to Latham, Rarden, and Shelocta soils on hillsides. The adjacent soils have fewer coarse fragments in the subsoil than the Brownsville soils.

Typical pedon of Brownsville channery silt loam, in an area of Shelocta-Brownsville association, steep, about 5.50 miles west of Waverly, in Pebble Township; about 3,000 feet west of Buchannon and Dailey Roads, along Dailey Road, then 70 feet north:

Oe—2 inches to 0; partially decomposed mixed hardwood leaf litter.

A—0 to 4 inches; very dark gray (10YR 3/1) channery silt loam, light brownish gray (10YR 6/2) dry; strong fine granular structure; very friable; many fine roots; about 15 percent coarse fragments; strongly acid; clear smooth boundary.

BE—4 to 10 inches; dark yellowish brown (10YR 4/4) channery silt loam; weak fine subangular blocky structure; friable; many medium roots; common fine vesicular pores; about 15 percent coarse fragments; very strongly acid; clear smooth boundary.

Bw1—10 to 18 inches; brown (7.5YR 5/4) channery silt loam; moderate fine subangular blocky structure; firm; common fine roots; common fine vesicular pores; common faint brown (7.5YR 5/4) silt coatings on faces of peds; about 25 percent coarse fragments; strongly acid; clear smooth boundary.

Bw2—18 to 26 inches; yellowish brown (10YR 5/6) very channery silt loam; moderate medium subangular blocky structure; firm; few fine roots; common fine vesicular pores; few faint yellowish brown (10YR 5/4) silt coatings; about 45 percent coarse fragments; strongly acid; clear wavy boundary.

Bw3—26 to 34 inches; yellowish brown (10YR 5/4) extremely channery silt loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; few prominent pale brown (10YR 6/3) silt coatings; few yellowish brown (10YR 5/6) and common brown (10YR 5/3) variegations; few fine black (N 2/0) concretions; about 65 percent coarse fragments; strongly acid; clear wavy boundary.

BC—34 to 44 inches; pale brown (10YR 6/3) extremely channery silty clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very firm; few fine vesicular pores; few distinct light gray (10YR 7/2) silt coatings; about 65 percent coarse fragments; strongly acid; clear wavy boundary.

C—44 to 48 inches; light yellowish brown (10YR 6/4) very channery silt loam; common medium faint yellowish brown (10YR 5/6) and common medium distinct light gray (10YR 7/2) mottles; massive; very firm; about 45 percent coarse fragments; strongly acid; abrupt smooth boundary.

R—48 to 52 inches; gray (10YR 6/1) soft, fine grained, massive sandstone.

The thickness of the solum ranges from 30 to 50 inches. The depth to bedrock ranges from 40 to 72 inches.

The A horizon has value of 3 or 4 and chroma of 1 to 4. The content of coarse fragments in this horizon ranges from 15 to 25 percent. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is channery, very channery, or extremely channery silt loam or loam. The content of coarse fragments ranges from 15 to 85 percent in individual subhorizons of the subsoil. The C horizon has hue of 2.5Y or 10YR and value and chroma of 4 to 6. It is very channery or extremely channery silt loam or loam. The content of coarse fragments in this horizon ranges from 35 to 90 percent.

Clifty Series

The Clifty series consists of deep, well drained, moderately rapidly permeable soils formed in local alluvium derived from sandstone and siltstone. These soils are on narrow flood plains. Slopes are 0 to 2 percent.

Clifty soils are commonly adjacent to Elkinsville, Shelocta, and Skidmore Variant soils. The adjacent soils have an argillic horizon. Elkinsville soils are on low stream terraces, Shelocta soils are on foot slopes and side slopes, and Skidmore Variant soils are on stream terraces and alluvial fans.

Typical pedon of Clifty silt loam, occasionally flooded, about 2.75 miles northwest of Morgantown, in Benton Township; about 0.5 mile west-northwest of the intersection of Egypt Hollow and Pike Lake Roads, along Egypt Hollow Road, then 125 feet southwest:

Oe—2 inches to 0; partially decomposed mixed hardwood leaf litter.

A—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; common roots; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

E/B—9 to 14 inches; about 60 percent brown (10YR 4/3) and 40 percent yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

Bw—14 to 30 inches; yellowish brown (10YR 5/6) gravelly loam; moderate medium subangular blocky structure; friable; few roots; about 20 percent coarse fragments; strongly acid; gradual smooth boundary.

C—30 to 60 inches; yellowish brown (10YR 5/4) very gravelly loam; massive; friable; about 50 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 20 to 40 inches. The A horizon has chroma of 2 to 4. The content of coarse fragments in this horizon ranges from 2 to 15 percent. The B horizon has value of 4 or 5 and chroma of 4 to 6. It is loam, silt loam, or the gravelly analogs of those textures. The content of coarse fragments in this horizon ranges from 10 to 35 percent. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is gravelly or very gravelly loam or silt loam. The content of coarse fragments in this horizon ranges from 20 to 60 percent.

Coolville Series

The Coolville series consists of deep, moderately well drained soils on broad or narrow ridgetops and on shoulder slopes in the uplands. These soils formed in a thin silty mantle and in the underlying material weathered from acid shale that has thin strata of siltstone. Permeability is moderate in the upper part of the profile and slow in the lower part. Slopes range from 1 to 20 percent.

Coolville soils are commonly adjacent to Blairton, Rarden, and Tilsit soils and are similar to Rarden and Wernock Variant soils. Blairton, Rarden, and Wernock Variant soils are moderately deep over bedrock. Blairton soils are on ridgetops and shoulder slopes. Rarden soils are on ridgetops and hillsides. Wernock Variant soils are on narrow ridgetops. Tilsit soils have a fragipan. They are on ridgetops.

Typical pedon of Coolville silt loam, in an area of Coolville-Blairton association, rolling, about 2.5 miles west of Morgantown, in Benton Township; about 3,300 feet northwest of the intersection of Green Ridge and Latham Roads, along Green Ridge Road, then 410 feet east:

Oe—1 inch to 0; partially decomposed pine needle duff.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; weak medium granular structure; friable; many coarse roots; very strongly acid; abrupt smooth boundary.

BE—7 to 10 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; many fine roots; very strongly acid; clear smooth boundary.

Bt1—10 to 14 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; many fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common faint pale brown (10YR 6/3) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt2—14 to 19 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint yellowish brown (10YR 5/6) and few medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure parting to moderate fine subangular blocky; friable; many fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 1 percent coarse fragments; very strongly acid; clear smooth boundary.

2Bt3—19 to 24 inches; light yellowish brown (10YR 6/4) silty clay; common medium prominent red (2.5YR 4/6) mottles; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; firm; many fine roots; many distinct gray (10YR 6/1) clay films on faces of peds; common faint pale brown (10YR 6/3) silt coatings on faces of peds; about 1 percent coarse fragments; extremely acid; clear wavy boundary.

2Bt4—24 to 33 inches; red (2.5YR 4/6) silty clay; common medium prominent grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; many prominent gray (N 5/0) clay films on vertical faces of peds; extremely acid; clear smooth boundary.

2Bt5—33 to 40 inches; strong brown (7.5YR 5/6) silty clay; few fine prominent red (2.5YR 4/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; many prominent gray (10YR 6/1) clay films on faces of peds; very strongly acid; clear smooth boundary.

BC—40 to 48 inches; yellowish brown (10YR 5/4) silty clay loam; few coarse distinct strong brown (7.5YR 5/6) and few coarse distinct gray (10YR 6/1) mottles; weak coarse subangular blocky structure; firm; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

2C—48 to 54 inches; yellowish brown (10YR 5/4), thinly bedded, soft shale bedrock.

The depth to bedrock and the thickness of the solum range from 40 to 60 inches. The content of coarse fragments ranges from 0 to 5 percent in the upper part of the profile and from 0 to 15 percent in the lower part.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The B horizon has hue of 7.5YR or 10YR and chroma of 4 to 6. It is silt loam or silty clay loam. The 2B horizon has hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 2 to 8. It is silty clay or silty clay loam. The bedrock is acid, clayey shale that has thin strata of siltstone.

Doles Series

The Doles series consists of deep, somewhat poorly drained, slowly permeable soils in slight depressions and along intermittent drainageways in preglacial valleys. These soils formed in a thin layer of loess and in the underlying colluvium or old alluvium. Slopes range from 0 to 3 percent.

Doles soils are commonly adjacent to Omulga and Wyatt soils in the slightly higher landscape positions. Omulga soils are moderately well drained. Wyatt soils do not have a fragipan.

Typical pedon of Doles silt loam, 0 to 3 percent slopes, about 0.25 mile northwest of Zahn's Corner, in Seal Township; about 1,050 feet west and 1,300 feet north of the southeast corner of sec. 27, T. 5 N., R. 21 W.

Ap—0 to 8 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; common fine dark brown (10YR 3/3) concretions; slightly acid; abrupt smooth boundary.

BE—8 to 14 inches; light yellowish brown (2.5Y 6/4) silt loam; common medium distinct light gray (10YR 7/2) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; common faint light brownish gray (10YR 6/2) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt—14 to 24 inches; light brownish gray (10YR 6/2) silty clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; moderate medium and coarse angular blocky structure; friable; few fine roots; common faint pinkish gray (7.5YR 6/2) clay films on faces of peds and in pores; many distinct light brownish gray (2.5Y 6/2) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Btx1—24 to 35 inches; yellowish brown (10YR 5/6) silt loam; few fine prominent light gray (10YR 7/2) mottles; weak very coarse prismatic structure; very firm; about 60 percent brittle in the upper part and 80 percent brittle in the lower part; common faint pinkish gray (7.5YR 6/2) clay films on faces of peds and in pores; many distinct light brownish gray (2.5Y 6/2) silt coatings on faces of peds; few fine black (N 2/0) stains (iron and manganese oxide); strongly acid; gradual smooth boundary.

Btx2—35 to 58 inches; yellowish brown (10YR 5/6) silt loam; few fine prominent light gray (10YR 7/2) and few medium distinct strong brown (7.5YR 5/8) mottles; moderate very coarse prismatic structure; very firm; brittle; common faint pinkish gray (7.5YR 6/2) clay films on faces of peds; many prominent light brownish gray (10YR 6/2) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

BC—58 to 69 inches; yellowish brown (10YR 5/6) silt loam; few medium distinct light gray (10YR 7/2) mottles; weak coarse prismatic structure; firm; common faint light gray (10YR 7/1) silt coatings on vertical faces of peds; medium acid.

The thickness of the solum ranges from 60 to 80 inches. The depth to bedrock is more than 60 inches. Depth to the top of the fragipan is 20 to 30 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt and Btx horizons are silt loam or silty clay loam. The Bt horizon has value of 5 or 6 and chroma of 2 to 4. The Btx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6.

Elkinsville Series

The Elkinsville series consists of deep, well drained, moderately permeable soils. These soils formed in silty alluvium on low stream terraces. Slopes are 0 to 2 percent.

Elkinsville soils are commonly adjacent to Genesee, Haymond, Huntington, and Martinsville soils and are similar to Parke soils. Genesee, Haymond, and Huntington soils are on flood plains. Genesee and Haymond soils have less clay in the subsoil than the Elkinsville soils. Huntington soils have a mollic epipedon. Martinsville soils have more sand and less silt in the subsoil than the Elkinsville soils. They are in landscape positions similar to those of the Elkinsville soils. Parke soils have more sand in the lower part of the subsoil than the Elkinsville soils. They are on the higher outwash plains and terraces.

Typical pedon of Elkinsville silt loam, rarely flooded, about 4.25 miles southwest of Piketon, in Scioto Township; about 2,200 feet south and 966 feet east of the northwest corner of sec. 8, T. 4 N., R. 22 W.

Ap—0 to 12 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; many roots; neutral; abrupt smooth boundary.

BA—12 to 18 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; firm; common roots; few fine vesicular pores; slightly acid; clear smooth boundary.

Bt1—18 to 28 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few roots; few faint brown (10YR 5/3) clay films on faces of peds; common distinct brown (10YR 5/3) silt coatings on faces of peds; few strong brown (7.5YR 5/6) variegations; medium acid; clear smooth boundary.

Bt2—28 to 40 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few roots; common fine vesicular pores; many distinct brown (10YR 5/3) and few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few dark brown (7.5YR 4/4) variegations; medium acid; clear smooth boundary.

Bt3—40 to 68 inches; yellowish brown (10YR 5/6) silty clay loam; weak medium subangular blocky structure; firm; few roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct brown (10YR 5/3) silt coatings on faces of peds; few coarse stains (iron and manganese oxide); strongly acid; clear smooth boundary.

C—68 to 71 inches; yellowish brown (10YR 5/6) silt loam; few fine prominent dark brown (7.5YR 4/4) mottles; massive; friable; strongly acid.

The depth to bedrock is more than 60 inches. The thickness of the solum ranges from 50 to 70 inches.

The Ap horizon has chroma of 2 to 4. The B and C horizons are silty clay loam or silt loam. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The C horizon has value of 4 or 5 and chroma of 3 to 6.

Ernest Series

The Ernest series consists of deep, moderately well drained soils formed in colluvium derived from shale, siltstone, and sandstone. These soils are on foot slopes along preglacial valley walls. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Slopes range from 8 to 15 percent.

Ernest soils are commonly adjacent to Clifty, Shelocta, and Wilbur soils. The adjacent soils do not have a fragipan. Clifty and Wilbur soils are on flood plains. Shelocta soils are on hillsides in the uplands.

Typical pedon of Ernest silt loam, 8 to 15 percent slopes, about 2.5 miles west of Stockdale, in Union Township; about 1,400 feet west and 2,050 feet north of the southeast corner of sec. 36, T. 4 N., R. 21 W.

Oe—1 inch to 0; partially decomposed pine needles and hardwood leaf litter.

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; weak medium granular structure; friable; common medium roots; about 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

Bt1—8 to 15 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few medium roots; few fine vesicular pores; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common faint dark yellowish brown (10YR 4/4) and light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 12 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—15 to 22 inches; yellowish brown (10YR 5/6) channery silty clay loam; few fine prominent light gray (10YR 7/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; few very fine vesicular pores; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 20 percent coarse fragments; strongly acid; clear wavy boundary.

Btx1—22 to 30 inches; yellowish brown (10YR 5/6) silt loam; few fine prominent light gray (10YR 7/2) and light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to weak thick platy; very firm; brittle; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 10 percent coarse fragments; strongly acid; gradual wavy boundary.

Btx2—30 to 42 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) and few fine distinct light gray (10YR 7/2) mottles; weak very coarse prismatic structure parting to weak thick platy; very firm; brittle; common faint yellowish brown (10YR 5/6) clay films on faces of peds; common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

BC1—42 to 54 inches; yellowish brown (10YR 5/6) silty clay loam; few fine prominent light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; very few faint yellowish brown (10YR 5/4) clay films on faces of peds; very few distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

BC2—54 to 72 inches; strong brown (7.5YR 5/8) silty clay loam; common fine prominent light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; very few faint yellowish brown (10YR 5/6) clay films on faces of peds; very few faint strong brown (7.5YR 5/8) silt coatings on faces of peds; about 5 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 45 to more than 72 inches. Depth to the top of the fragipan ranges from 20 to 36 inches. The content of coarse fragments ranges from 5 to 25 percent above the fragipan and from 5 to 20 percent in the fragipan and in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. Some pedons have an E or BE horizon, which is as much as 5 inches thick. The Bt horizon has hue of 10YR or 7.5YR and chroma of 4 to 6. It is silt loam, silty clay loam, and the channery analogs of those textures. The Btx horizon has chroma of 4 to 6. It is loam, silt loam, clay loam, or the channery analogs of those textures.

Fox Series

The Fox series consists of deep, well drained soils formed in loamy outwash over outwash of sand and gravel. These soils are on Wisconsinan outwash terraces. Permeability is moderate in the solum and rapid or very rapid in the underlying material. Slopes range from 0 to 12 percent.

Fox soils are commonly adjacent to Elkinsville soils on low stream terraces and Genesee, Huntington, and Stonelick soils on flood plains. Elkinsville soils have less sand and gravel in the subsoil than the Fox soils, and Genesee soils have less gravel throughout. Huntington soils have a thick mollic epipedon. Stonelick soils have more sand and less clay in the upper part than the Fox soils.

Typical pedon of Fox loam, 0 to 2 percent slopes, about 3 miles south-southwest of Piketon, in Scioto Township; 1,650 feet east and 90 feet north of the center of sec. 5, T. 4 N., R. 22 W.

Ap—0 to 9 inches; brown (10YR 4/3) loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many roots; about 5 percent gravel; neutral; abrupt smooth boundary.

Bt1—9 to 17 inches; dark brown (7.5YR 4/4) clay loam; weak medium subangular blocky structure parting to moderate fine subangular blocky; friable; common roots; few faint brown (7.5YR 4/4) clay films on pebbles and on faces of peds; about 10 percent gravel; slightly acid; clear smooth boundary.

Bt2—17 to 29 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; friable; few roots; many faint dark brown (7.5YR 4/4) clay films on faces of peds; about 20 percent gravel; slightly acid; abrupt irregular boundary.

2C—29 to 60 inches; brown (7.5YR 5/4) very gravelly sand; single grained; loose; about 50 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The B horizon has hue of 10YR or 7.5YR and chroma of 3 to 5. It is clay loam, silty clay loam, loam, or the gravelly analogs of those textures. The content of gravel in this horizon ranges from 2 to 25 percent. The 2C horizon has hue of 10YR or 7.5YR and chroma of 3 or 4. It is gravelly or very gravelly sand.

Genesee Series

The Genesee series consists of deep, well drained, moderately permeable soils formed in alluvium on broad flood plains. Slopes are 0 to 2 percent.

Genesee soils are commonly adjacent to Huntington, Martinsville, and Stonelick soils and are similar to Haymond, Stonelick, and Wilbur soils. Haymond soils have less sand and more silt in the upper part than the Genesee soils. Huntington soils have a mollic epipedon. They are in the higher positions on flood plains. Martinsville soils are on low stream terraces. They have more clay in the subsoil than the Genesee soils. Stonelick soils have more sand in the upper part than the Genesee soils. They are on slope breaks and along drainageways. Wilbur soils are moderately well drained.

Typical pedon of Genesee silt loam, occasionally flooded, about 3 miles southwest of Piketon, in Scioto Township; about 720 feet east and 200 feet south of the northwest corner of sec. 5, T. 4 N., R. 22 W.

Ap—0 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; many roots; neutral; abrupt smooth boundary.

C1—11 to 14 inches; brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable; common roots; dark brown (10YR 3/3) coatings of material from the Ap horizon on faces of peds; about 1 percent gravel; neutral; abrupt smooth boundary.

C2—14 to 28 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium and fine subangular blocky structure; friable; thin strata of loam; neutral; clear wavy boundary.

C3—28 to 40 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; few roots; thin strata of silt loam; brown (10YR 4/3) organic coatings on faces of some peds; slight effervescence; mildly alkaline; abrupt wavy boundary.

C4—40 to 60 inches; dark yellowish brown (10YR 4/4) sandy loam; massive; very friable; slight effervescence; mildly alkaline.

The depth to bedrock is more than 60 inches. The depth to free carbonates ranges from 25 to 40 inches.

The Ap horizon has value and chroma of 3 or 4. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is typically stratified silt loam, loam, or sandy loam.

Gilpin Series

The Gilpin series consists of moderately deep, well drained, moderately permeable soils. These soils formed in material weathered from sandstone and siltstone on ridgetops, shoulder slopes, and side slopes in the uplands. Slopes range from 3 to 25 percent.

Gilpin soils are commonly adjacent to Blairton, Coolville, Rarden, and Tilsit soils and are similar to Blairton and Wharton soils. Blairton, Tilsit, and Wharton soils are moderately well drained. Coolville and Rarden soils have more clay in the subsoil than the Gilpin soils. Tilsit soils have a fragipan. Blairton and Coolville soils are on ridgetops and shoulder slopes. Rarden soils are on ridgetops and hillsides. Tilsit soils are on ridgetops. Wharton soils are on hillsides.

Typical pedon of Gilpin silt loam, 8 to 15 percent slopes, about 3 miles northeast of Idaho, in Pebble Township; about 1,300 feet east of the intersection of Ware Road and State Route 772, along Ware Road, then 75 feet north:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; many fine roots; about 10 percent coarse fragments; slightly acid; clear smooth boundary.

Bt1—6 to 12 inches; strong brown (7.5YR 5/6) channery silt loam; moderate fine subangular blocky structure; firm; common fine roots; common fine vesicular pores; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 20 percent coarse fragments; medium acid; clear smooth boundary.

Bt2—12 to 16 inches; strong brown (7.5YR 5/6) channery silt loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; common faint brown (7.5YR 5/4) clay films on faces of peds; about 30 percent coarse fragments; strongly acid; clear smooth boundary.

Bt3—16 to 20 inches; strong brown (7.5YR 5/8) very channery silt loam; weak medium subangular blocky structure; firm; few very fine roots; few fine vesicular pores; common faint reddish yellow (7.5YR 6/6) clay films on faces of peds; about 40 percent coarse fragments; very strongly acid; abrupt smooth boundary.

R—20 to 25 inches; strong brown (7.5YR 5/6), massive siltstone bedrock.

The depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments ranges from 5 to 40 percent in individual subhorizons of the subsoil.

The Ap horizon has value of 3 or 4 and chroma of 2 to 4. It is silt loam or channery silt loam. The B horizon has hue of 10YR or 7.5YR and chroma of 4 to 8. It is silt loam, loam, silty clay loam, or the channery or very channery analogs of those textures. The R horizon is siltstone or sandstone. It has colors similar to those of the B horizon.

Haymond Series

The Haymond series consists of deep, well drained, moderately permeable soils formed in alluvium on flood plains. Slopes are 0 to 2 percent.

Haymond soils are commonly adjacent to Clifty, Elkinsville, Skidmore Variant, and Stendal soils and are similar to Genesee and Wilbur soils. Clifty and Skidmore Variant soils have a higher content of coarse fragments in the subsoil than the Haymond soils. Clifty soils are on narrow flood plains. Skidmore Variant soils are on stream terraces and alluvial fans. Elkinsville soils have an argillic horizon. They are on low stream terraces. Genesee soils contain more clay in the subsoil than the Haymond soils. The somewhat poorly drained Stendal soils are in the lower positions on flood plains. Wilbur soils are moderately well drained.

Typical pedon of Haymond silt loam, occasionally flooded, about 0.38 mile southwest of Idaho, in Sunfish Township; about 1,320 feet southwest of the intersection of State Route 124 and Beaver Ridge Road, along Beaver Ridge Road, then about 1,490 feet northwest:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; neutral; clear smooth boundary.

C1—7 to 20 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; common fine roots; few fine vesicular pores; many distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; neutral; gradual smooth boundary.

C2—20 to 32 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; common distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; slightly acid; clear smooth boundary.

C3—32 to 45 inches; yellowish brown (10YR 5/4) silt loam; common fine faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

C4—45 to 58 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct grayish brown (10YR 5/2) and common fine faint dark yellowish brown (10YR 4/4) mottles; massive; friable; few fine roots; few fine bedding planes; slightly acid; clear smooth boundary.

C5—58 to 72 inches; brown (10YR 5/3), stratified silt loam and loam; massive; friable; common medium bedding planes; slightly acid.

The Ap horizon has chroma of 2 to 4. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam, loam, or fine sandy loam.

Huntington Series

The Huntington series consists of deep, well drained, moderately permeable soils formed in alluvium on broad flood plains. Slopes are 0 to 2 percent.

Huntington soils are commonly adjacent to Elkinsville, Genesee, Martinsville, and Stonelick soils. The adjacent soils do not have a mollic epipedon. Elkinsville and Martinsville soils are on low stream terraces. Genesee soils are in the lower positions on flood plains. Stonelick soils are on slope breaks and along drainageways.

Typical pedon of Huntington silt loam, occasionally flooded, about 2.50 miles southwest of Piketon, in Seal Township; about 800 feet north and 1,500 feet east of the southwest corner of sec. 2, T. 4 N., R. 22 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to moderate fine granular; friable; many roots; very dark grayish brown (10YR 3/2) organic coatings; mildly alkaline; abrupt smooth boundary.

A—9 to 22 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure parting to moderate coarse granular; friable; few roots; mildly alkaline; clear wavy boundary.

Bw1—22 to 29 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; few roots; many dark grayish brown (10YR 4/2) coatings on faces of peds; neutral; clear wavy boundary.

Bw2—29 to 44 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few roots; common dark grayish brown (10YR 4/2) coatings on faces of peds; neutral; clear smooth boundary.

BC—44 to 50 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; very friable; few roots; very few dark grayish brown (10YR 4/2) coatings on faces of peds; neutral; clear smooth boundary.

C1—50 to 59 inches; brown (10YR 4/3) loam; massive; very friable; neutral; clear smooth boundary.

C2—59 to 65 inches; dark yellowish brown (10YR 4/4) loamy sand; single grained; loose; neutral.

The solum ranges from 40 to 60 inches in thickness. The thickness of the mollic epipedon ranges from 10 to 24 inches. The content of gravel is 0 to 3 percent in the solum and 0 to 35 percent in the C horizon.

The A horizon has chroma of 2 or 3. When dry, it has value of 4 or 5 and chroma of 2 or 3. The B horizon has value of 4 or 5 and chroma of 3 or 4. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is stratified silt loam, loam, sandy loam, loamy sand, or the gravelly analogs of those textures.

Latham Series

The Latham series consists of moderately deep, moderately well drained, slowly permeable soils. These soils formed in colluvium and residuum derived from acid shale that has thin layers of siltstone. They are on dissected toe slopes, ridgetops, and side slopes in the uplands. Slopes range from 8 to 40 percent.

Latham soils are commonly adjacent to Bratton, Shelocta, Trappist, and Wharton soils and are similar to Rarden and Trappist soils. Bratton soils are underlain by dolomitic limestone and are less acid throughout than the Latham soils. They are on ridgetops and shoulder slopes. Rarden soils typically are redder in the subsoil than the Latham soils. The deep Shelocta and Wharton soils are on hillsides. Trappist soils are well drained and are on hillsides.

Typical pedon of Latham silt loam, in an area of Latham-Wharton silt loams, 15 to 25 percent slopes, about 2 miles north of Waverly, in Pee Pee Township; about 5,400 feet north of the intersection of Prussia and Denver Roads, along Prussia Road, then 810 feet southwest:

Oe—2 inches to 0; partially decomposed mixed hardwood leaf litter.

A—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; very friable; many very fine and fine roots; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

E—2 to 8 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; firm; many very fine and few fine roots; few fine vesicular pores; about 12 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt1—8 to 15 inches; reddish yellow (7.5YR 6/8) silty clay loam; moderate medium subangular blocky structure; firm; few very fine roots; few fine vesicular pores; many faint strong brown (7.5YR 5/6) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—15 to 22 inches; strong brown (7.5YR 5/6) silty clay; common fine prominent pinkish gray (7.5YR 6/2) and common fine distinct yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; firm; few very fine roots; few fine vesicular pores; many distinct pale brown (10YR 6/3) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt3—22 to 34 inches; light olive brown (2.5Y 5/4) channery silty clay; many fine prominent pinkish gray (7.5YR 6/2), common fine prominent strong brown (7.5YR 5/8), and few fine prominent yellowish red (5YR 5/8) mottles; moderate coarse subangular blocky structure; very firm; few very fine roots; few fine vesicular pores; many prominent light brownish gray (2.5Y 6/2) clay films on faces of peds; about 15 percent coarse fragments; very strongly acid; gradual smooth boundary.

Cr—34 to 38 inches; light olive brown (2.5Y 5/4) and light brownish gray (2.5Y 6/2), soft shale interbedded with some thin layers of yellowish brown (10YR 5/6) siltstone.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8. It is silty clay loam, silty clay, or the channery analogs of those textures. The content of coarse fragments in this horizon ranges from 0 to 30 percent. Some pedons have a C horizon above the Cr horizon.

Markland Series

The Markland series consists of deep, moderately well drained and well drained, slowly permeable soils.

These soils formed in calcareous lacustrine deposits on terraces. In some areas they have a thin mantle of loess. Slopes range from 3 to 25 percent.

Markland soils are commonly adjacent to McGary, Montgomery Variant, Negley, and Otwell soils and are similar to Wyatt soils. The poorly drained McGary soils are in the lower positions on the lacustrine terraces. The very poorly drained Montgomery Variant soils are in depressions on flood plains that transect lacustrine and outwash terraces. Negley and Otwell soils are on outwash terraces. Negley soils have more sand and gravel in the subsoil than the Markland soils. Otwell soils have a fragipan. Wyatt soils are more acid in the subsoil than the Markland soils.

Typical pedon of Markland silty clay loam, 8 to 15 percent slopes, eroded, about 0.75 mile east of Cynthiana, in Perry Township; 3,960 feet east-northeast of the intersection of State Route 41 and Muddy Fork Road, along Muddy Fork Road, then 135 feet north:

Ap—0 to 7 inches; brown (10YR 4/3) silty clay loam, light yellowish brown (10YR 6/4) dry; weak coarse granular structure; firm; common fine roots; few fine vesicular pores; about 5 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bt1—7 to 13 inches; yellowish brown (10YR 5/4) silty clay; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common fine vesicular pores; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—13 to 20 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very firm; few fine roots; common fine vesicular pores; many distinct dark yellowish brown (10YR 4/4) and common distinct brown (10YR 5/3) clay films on faces of peds; neutral; clear wavy boundary.

Bt3—20 to 24 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; very firm; few fine roots; few fine vesicular pores; many distinct grayish brown (10YR 5/2) clay films; very pale brown (10YR 7/3) streaks of calcium carbonate; neutral; clear wavy boundary.

Bt4—24 to 28 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to moderate medium subangular blocky; very firm; many distinct grayish brown (10YR 5/2) clay films; common medium very pale brown (10YR 7/3) streaks of calcium carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C1—28 to 40 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; very firm; many distinct light brownish gray (10YR 6/2) coatings of calcium carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C2—40 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; massive; very firm; many medium light brownish gray (10YR 6/2) coatings of calcium carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to bedrock is more than 60 inches.

The Ap horizon has chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam, clay, or silty clay. The C horizon has value of 4 to 6 and chroma of 2 to 4. It is dominantly silty clay loam, silty clay, or clay. In some pedons, however, it has strata of silt loam.

Martinsville Series

The Martinsville series consists of deep, well drained, moderately permeable soils formed in alluvium on low stream terraces. Slopes are 0 to 2 percent.

Martinsville soils are commonly adjacent to Elkinsville soils on low stream terraces and Genesee and Huntington soils on flood plains. Elkinsville soils have less sand and more silt in the subsoil than the Martinsville soils. Genesee soils do not have an argillic horizon. Huntington soils have a mollic epipedon.

Typical pedon of Martinsville loam, rarely flooded, about 2 miles east of Omega, in Jackson Township; about 1.8 miles east of the intersection of State Route 335 and Schilder Lane, along Schilder Lane, then 300 feet north:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; common fine and medium roots; about 1 percent gravel; medium acid; abrupt smooth boundary.

AB—8 to 11 inches; brown (10YR 4/3) and strong brown (7.5YR 5/6) loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; friable; common fine roots; medium acid; clear smooth boundary.

Bt1—11 to 20 inches; strong brown (7.5YR 5/6) loam; moderate coarse prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; few fine vesicular pores; many distinct brown (10YR 4/3) clay films on faces of peds; common distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; medium acid; clear smooth boundary.

Bt2—20 to 29 inches; strong brown (7.5YR 5/6) clay loam; moderate coarse prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; few fine vesicular pores; common distinct brown (10YR 4/3) clay films on faces of peds; common distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; medium acid; abrupt smooth boundary.

Bt3—29 to 42 inches; strong brown (7.5YR 5/6) sandy loam; weak coarse subangular blocky structure; friable; common distinct brown (10YR 4/3) clay films on faces of peds; medium acid; abrupt smooth boundary.

C1—42 to 63 inches; dark yellowish brown (10YR 4/4), stratified loamy sand and sandy loam; single grained; loose; about 2 percent gravel; slight effervescence; mildly alkaline; abrupt smooth boundary.

C2—63 to 70 inches; yellowish brown (10YR 5/4), stratified sand and loamy sand; single grained; loose; about 2 percent gravel; slight effervescence; mildly alkaline.

The solum ranges from 40 to 60 inches in thickness. The Ap horizon has value of 3 or 4 and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, loam, sandy loam, silty clay loam, or sandy clay loam. The C horizon has value of 4 or 5 and chroma of 4 to 6. It is stratified sandy loam, loamy sand, sand, or gravelly sand.

McGary Series

The McGary series consists of deep, somewhat poorly drained, slowly permeable or very slowly permeable soils. These soils formed in lacustrine sediments on slight rises on lacustrine terraces and in preglacial valleys. Slopes range from 0 to 4 percent.

McGary soils are commonly adjacent to Markland, Montgomery Variant, Negley, Otwell, and Purdy Variant soils and are similar to Purdy Variant soils. The moderately well drained and well drained Markland soils are in the more sloping areas. The very poorly drained Montgomery Variant soils are on flood plains. Negley and Otwell soils are on outwash terraces. Negley soils are well drained, and Otwell soils have a fragipan. The poorly drained Purdy Variant soils are in depressions.

Typical pedon of McGary silt loam, 0 to 4 percent slopes, about 1.5 miles northeast of Omega, in Jackson Township; 7,500 feet northeast of the intersection of State Route 335 and Higby Road, along Higby Road, then 1,000 feet south:

Ap—0 to 8 inches; grayish brown (2.5Y 5/2) silt loam, light brownish gray (2.5Y 6/2) dry; moderate medium granular structure; friable; many fine roots; strongly acid; abrupt smooth boundary.

Bt—8 to 15 inches; light olive brown (2.5Y 5/4) silty clay; common fine faint grayish brown (2.5Y 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common very fine roots; few very fine vesicular pores; many distinct gray (10YR 5/1) clay films on faces of peds; strongly acid; clear wavy boundary.

Btg1—15 to 26 inches; gray (10YR 5/1) silty clay; few fine distinct light olive brown (2.5Y 5/4) and few fine prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; few very fine vesicular pores; many prominent gray (10YR 6/1) clay films on faces of peds; few gray (N 6/0) faces on slickensides; medium acid; clear wavy boundary.

Btg2—26 to 36 inches; grayish brown (2.5Y 5/2) silty clay; common fine faint light olive brown (2.5Y 5/4) mottles; moderate coarse subangular blocky structure; firm; few very fine vesicular pores; many prominent olive gray (5Y 5/2) clay films on faces of peds; common olive gray (5Y 5/2) faces on slickensides; medium acid; clear wavy boundary.

Btg3—36 to 40 inches; olive gray (5Y 5/2) clay; few medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; many faint dark gray (5Y 4/1) clay films on faces of peds; mildly alkaline; clear wavy boundary.

Cg1—40 to 56 inches; 60 percent light brownish gray (10YR 6/2) and 40 percent yellowish brown (10YR 5/4) and gray (10YR 5/1), variegated silty clay loam; weak coarse subangular blocky structure; firm; dark gray (10YR 4/1) clay flows; about 1 percent coarse fragments; slight effervescence; moderately alkaline; gradual wavy boundary.

Cg2—56 to 60 inches; 60 percent light brownish gray (10YR 6/2) and 40 percent yellowish brown (10YR

5/4), strong brown (7.5YR 5/6), and gray (N 5/0), variegated silty clay loam; massive; laminated; very firm; common pinkish gray (7.5YR 7/2) streaks of calcium carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches. The depth to bedrock is more than 60 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. The Bt horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is silty clay, silty clay loam, or clay. The C horizon has hue of 7.5YR to 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 6. It is silty clay loam, silty clay, or clay. It is stratified in many pedons.

Melvin Series

The Melvin series consists of deep, poorly drained, moderately permeable soils formed in alluvium on flood plains. Slopes are 0 to 2 percent.

Melvin soils are commonly adjacent to the somewhat poorly drained Stendal and moderately well drained Wilbur soils in the higher positions on the flood plains.

Typical pedon of Melvin silt loam, occasionally flooded, about 2.5 miles southwest of Beaver, in Marion Township; about 780 feet east and 550 feet south of the northwest corner of sec. 8, T. 5 N., R. 20 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; few fine prominent yellowish red (5YR 4/6) mottles; weak fine granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

Cg1—8 to 14 inches; light brownish gray (2.5Y 6/2) silt loam; common medium prominent yellowish red (5YR 5/8) mottles; weak medium prismatic structure parting to weak medium granular; firm; few fine roots; few fine vesicular pores; medium acid; clear smooth boundary.

Cg2—14 to 20 inches; light brownish gray (10YR 6/2) silt loam; weak medium granular structure; firm; few fine roots; few fine vesicular pores; few fine very dark gray (10YR 3/1) stains (iron and manganese oxide); about 2 percent coarse fragments; medium acid; gradual smooth boundary.

Cg3—20 to 26 inches; light brownish gray (10YR 6/2) silt loam; common fine faint pale brown (10YR 6/3) mottles; massive; firm; few fine vesicular pores; common fine very dark gray (10YR 3/1) stains (iron and manganese oxide); about 2 percent coarse fragments; medium acid; gradual smooth boundary.

Cg4—26 to 38 inches; light gray (10YR 7/2) silt loam; few medium prominent brownish yellow (10YR 6/6) few medium distinct light yellowish brown (10YR 6/4) and few medium distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; few fine vesicular pores; many fine very dark gray (10YR 3/1) stains and concretions (iron and manganese oxide); about 2 percent coarse fragments; strongly acid; gradual smooth boundary.

Cg5—38 to 80 inches; light gray (10YR 7/2) loam; few fine distinct light yellowish brown (10YR 6/4), common medium prominent yellowish brown (10YR 5/6), and many fine faint gray (10YR 6/1) mottles; massive; firm; few fine vesicular pores; very strongly acid.

The depth to bedrock is more than 60 inches. The Ap horizon has value of 4 or 5 and chroma of 1 or 2. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. It is dominantly silt loam; however, loam is below a depth of 35 inches in many pedons.

Miami Variant

The Miami Variant consists of deep, well drained, slowly permeable soils on glaciated hillsides in the uplands. These soils formed in glacial till and material weathered from acid shale bedrock. Slopes range from 15 to 30 percent.

Miami Variant soils are commonly adjacent to Miamian, Shelocta, and Trappist soils. Miamian soils have more clay in the upper part of the subsoil than the Miami Variant soils. They are on glaciated foot slopes. Shelocta and Trappist soils are in unglaciated areas on hillsides. Shelocta soils have fewer rounded fragments in the upper part than the Miami Variant soils. Trappist soils are moderately deep over fissile shale bedrock.

Typical pedon of Miami Variant silt loam, 15 to 30 percent slopes, about 4 miles northeast of Cynthiana, in Perry Township; about 4,600 feet north of the intersection of Pine Top and Massie Run Roads, along Massie Run Road, then 1,100 feet east:

Oe—2 inches to 0; partially decomposed mixed hardwood leaf litter.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; very friable; many medium roots; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—5 to 13 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine subangular blocky structure;

firm; common medium roots; common fine vesicular pores; few faint yellowish brown (10YR 5/4) clay films on vertical faces of peds; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—13 to 19 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; common fine vesicular pores; many faint yellowish brown (10YR 5/6) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt3—19 to 25 inches; yellowish brown (10YR 5/6) silty clay loam; few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few medium roots; few fine vesicular pores; many faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

2Bt4—25 to 32 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct grayish brown (10YR 5/2) and light gray (10YR 6/1) and common fine faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; few very fine pores; many distinct brown (10YR 4/3) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

2Bt5—32 to 42 inches; yellowish brown (10YR 5/4) silty clay; common medium faint yellowish brown (10YR 5/6) and few medium distinct light gray (10YR 6/1) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; many distinct grayish brown (10YR 5/2) clay films on vertical faces of peds; about 5 percent coarse fragments; slight effervescence in spots below a depth of 36 inches; slightly acid; clear smooth boundary.

2Cr—42 to 45 inches; dark gray (10YR 4/1), gray (10YR 5/1), and yellowish brown (10YR 5/6), weathered, platy, soft, fissile shale.

2R—45 to 49 inches; dark gray (10YR 4/1) platy, fissile shale.

The thickness of the solum ranges from 30 to 60 inches. The depth to horizons that formed in shale residuum ranges from 20 to 40 inches, and the depth to paralithic or lithic contact ranges from 40 to 70 inches. The content of coarse fragments of mixed lithology is 2 to 15 percent in the A and B horizons. The content of coarse fragments in the 2B horizon ranges from 5 to 35 percent.

The A horizon has value of 3 or 4 and chroma of 2 or 3. The B and 2B horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The B horizon is silty clay loam or clay loam. The 2B horizon is silty clay, clay, or the channery analogs of those textures.

Miamian Series

The Miamian series consists of deep, well drained, moderately slowly permeable soils. These soils formed in till that has a high content of lime. They are on glaciated foot slopes in the uplands. Slopes range from 15 to 25 percent.

Miamian soils are commonly adjacent to Miami Variant and Negley soils. Miami Variant soils are on glaciated hillsides in the uplands. They have less clay in the subsoil than the Miamian soils and are 40 to 70 inches deep over shale. Negley soils are on outwash terraces. They have a solum that is thicker than that of the Miamian soils.

Typical pedon of Miamian clay loam, 15 to 25 percent slopes, severely eroded, about 4 miles northeast of Cynthiana, in Perry Township; about 5,000 feet north of the intersection of Pine Top and Massie Run Roads, along Massie Run Road, then about 1,200 feet east:

A—0 to 5 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; about 5 percent coarse fragments; neutral; clear smooth boundary.

Bt1—5 to 10 inches; yellowish brown (10YR 5/4) clay loam; moderate fine subangular blocky structure; firm; common fine roots; few fine vesicular pores; many distinct brown (10YR 4/3) clay films on faces of peds; common strong brown (7.5YR 5/6) variegations; about 10 percent coarse fragments; medium acid; clear smooth boundary.

Bt2—10 to 19 inches; brown (7.5YR 5/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; few very fine vesicular pores; many distinct brown (10YR 4/3) clay films on faces of peds; common strong brown (7.5YR 5/6) variegations; about 10 percent coarse fragments; neutral; gradual wavy boundary.

Bt3—19 to 29 inches; yellowish brown (10YR 5/4) clay loam; weak medium subangular blocky structure; firm; few fine roots; few very fine vesicular pores; many distinct brown (10YR 4/3) clay films on faces of peds; few strong brown (7.5YR 5/6) variegations; about 10 percent coarse fragments; mildly alkaline; clear smooth boundary.

Bt4—29 to 36 inches; yellowish brown (10YR 5/4) clay loam; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; few very fine vesicular pores; many distinct brown (10YR 4/3) clay films on faces of peds; about 5 percent coarse fragments; slight effervescence; mildly alkaline; gradual smooth boundary.

C—36 to 60 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct brown (10YR 4/3) and few medium faint yellowish brown (10YR 5/6) mottles; massive; very firm; about 5 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 40 inches. The content of coarse fragments ranges from 2 to 15 percent throughout the profile.

The A horizon has chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam or silty clay loam. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam.

Montgomery Variant

The Montgomery Variant consists of deep, very poorly drained, slowly permeable or very slowly permeable soils. These soils formed in recent alluvium and in the underlying lacustrine sediments. They are in depressions on flood plains that transect lacustrine and outwash terraces. Slopes are 0 to 2 percent.

Montgomery soils are commonly adjacent to Markland and McGary soils on lacustrine terraces and Otwell soils on outwash terraces. Markland soils are moderately well drained and well drained. McGary soils are somewhat poorly drained. Otwell soils have a fragipan.

Typical pedon of Montgomery Variant silt loam, frequently flooded, about 1.5 miles southeast of Cynthiana, in Perry Township; about 1.2 miles east of the intersection of State Route 41 and Frost Road, then 150 feet north:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate fine and medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; common faint dark brown (10YR 3/3) organic coatings; neutral; abrupt smooth boundary.

AC—8 to 12 inches; brown (10YR 4/3) silt loam; few fine distinct reddish brown (5YR 4/4) mottles; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; common faint brown (10YR 5/3) silt coatings on faces of peds; about 1 percent coarse fragments; slightly acid; clear smooth boundary.

C—12 to 17 inches; brown (10YR 4/3) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; common fine roots; many fine vesicular pores; few medium prominent very dark gray (N 3/0) worm casts; common faint brown (10YR 4/3) silt coatings on faces of peds; slightly acid; abrupt smooth boundary.

2Ab—17 to 22 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium prismatic structure parting to moderate coarse angular blocky; firm; few fine roots; few fine vesicular pores; common prominent yellowish brown (10YR 5/4) silt coatings on faces of peds; slightly acid; clear smooth boundary.

2Bgb1—22 to 45 inches; very dark gray (10YR 3/1) silty clay loam; few fine prominent dark brown (7.5YR 4/4) and few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; few fine vesicular pores; many faint dark gray (10YR 4/1) clay films on faces of peds; common prominent yellowish brown (10YR 5/4) silt coatings on faces of peds; slightly acid; abrupt smooth boundary.

2Bgb2—45 to 55 inches; variegated very dark gray (N 3/0), dark gray (N 4/0), dark grayish brown (10YR 4/2), and gray (10YR 5/1) silty clay loam; weak medium and coarse subangular blocky structure; firm; slightly acid; clear smooth boundary.

2Cg—55 to 71 inches; variegated strong brown (7.5YR 5/8) and gray (n 5/0 and 6/0) silty clay loam; massive; firm; slightly acid.

The solum ranges from 40 to 60 inches in thickness. The recent alluvium is 10 to 20 inches thick. The content of gravel is 0 to 5 percent in the solum.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The AC and C horizons have value of 4 or 5 and chroma of 3 to 6. They are silt loam or silty clay loam. The 2Ab horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3. It is silt loam or silty clay loam. The 2Bgb horizon has hue of 10YR or is neutral in hue. It has value of 3 or 4 and chroma of 0 to 2. It is silt loam, silty clay loam, or silty clay. The 2C horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 3 to 6 and chroma of 0 to 8. It is silt loam, silty clay loam, or loam.

Negley Series

The Negley series consists of deep, well drained soils on knolls, at the head of drainageways, and on side slopes on outwash terraces. These soils formed in Illinoian outwash. Permeability is moderate or moderately rapid. Slopes range from 8 to 35 percent.

Negley soils are commonly adjacent to Markland, Otwell, Parke, and Taggart soils and are similar to Princeton soils. Markland soils have more clay in the subsoil than the Negley soils. They are on lacustrine terraces. Otwell and Parke soils have more silt in the upper part of the subsoil than the Negley soils. They are on the less sloping parts of outwash plains and terraces. Princeton soils have less gravel in the subsoil than the Negley soils. The somewhat poorly drained Taggart soils are in slight depressions.

Typical pedon of Negley loam, 25 to 35 percent slopes, about 1.5 miles northeast of Omega, in Jackson Township; 1.75 miles northeast of the intersection of State Route 335 and Higby Road, along Higby Road, than 2,000 feet south.

Ap—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; about 5 percent gravel; strongly acid; abrupt smooth boundary.

A—3 to 6 inches; brown (10YR 4/3) loam; moderate medium granular structure; friable; common very fine roots; few very fine vesicular pores; about 5 percent gravel; strongly acid; clear smooth boundary.

Bt1—6 to 11 inches; yellowish red (5YR 5/6) loam; common fine subangular blocky structure; firm; common very fine roots; few fine vesicular pores; many distinct reddish brown (5YR 5/4) clay films on faces of peds; about 10 percent gravel; strongly acid; clear smooth boundary.

Bt2—11 to 19 inches; yellowish red (5YR 5/6) gravelly clay loam; moderate medium subangular blocky structure; firm; few very fine roots; few fine vesicular pores; many distinct yellowish red (5YR 4/6) clay films on faces of peds; about 15 percent gravel; very strongly acid; clear wavy boundary.

Bt3—19 to 36 inches; strong brown (7.5YR 5/6) gravelly clay loam; moderate medium subangular blocky structure; firm; few very fine roots; few very fine vesicular pores; common faint dark brown (7.5YR 4/4) clay films on faces of peds; about 30 percent gravel; strongly acid; clear wavy boundary.

Bt4—36 to 47 inches; dark brown (7.5YR 4/4) gravelly clay loam; few fine faint strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; firm; common faint dark brown (7.5YR 4/4) clay films on faces of peds; about 20 percent gravel; strongly acid; gradual wavy boundary.

Bt5—47 to 54 inches; dark brown (7.5YR 4/4) gravelly loam; weak coarse subangular blocky structure; firm; common faint dark brown (7.5YR 4/4) clay films on faces of peds; about 15 percent gravel; strongly acid; gradual wavy boundary.

Bt6—54 to 60 inches; strong brown (7.5YR 5/6) gravelly clay loam; weak coarse subangular blocky structure; firm; many faint dark brown (7.5YR 4/4) clay films on faces of peds; about 20 percent gravel; medium acid; clear wavy boundary.

Bt7—60 to 80 inches; yellowish red (5YR 5/6) gravelly clay loam; weak coarse subangular blocky structure; firm; many distinct strong brown (7.5YR 5/6) clay films on faces of peds; about 15 percent gravel; medium acid.

The thickness of the solum ranges from 80 to 150 inches. The depth to bedrock is more than 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. It is loam, clay loam, sandy loam, sandy clay loam, or the gravelly analogs of those textures. The content of gravel in this horizon ranges from 5 to 35 percent.

Omulga Series

The Omulga series consists of deep, moderately well drained soils on slight rises, at the head of drainageways, in high saddles, and on side slopes in preglacial valleys. These soils formed in loess, colluvium, and old alluvium. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 0 to 15 percent.

Omulga soils are commonly adjacent to Doles, Richland, and Wyatt soils and are similar to Otwell and Tilsit soils. The somewhat poorly drained Doles soils are in the slightly lower areas. Otwell soils have glacial pebbles within a depth of 40 inches. Richland and Wyatt soils do not have a fragipan. Richland soils are on foot slopes along the north side of the preglacial valleys. Wyatt soils are on knolls and side slopes above or below the Omulga soils. Tilsit soils have thin, flat stone fragments in the lower part.

Typical pedon of Omulga silt loam, 3 to 8 percent slopes, about 1.25 miles north of Zahn's Corner, in Seal Township; about 1,000 feet west and 1,660 feet north of the southeast corner of sec. 18, T. 5 N., R. 21 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak coarse granular structure parting to weak fine granular; friable; many fine roots; few fine dark brown (10YR 3/3) concretions; neutral; abrupt smooth boundary.

AB—7 to 10 inches; 70 percent dark grayish brown (10YR 4/2) and 30 percent yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; neutral; abrupt wavy boundary.

Bt1—10 to 19 inches; yellowish brown (10YR 5/8) silt loam; few fine faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine roots; very few faint yellowish brown (10YR 5/4) clay films on faces of peds; many distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt2—19 to 27 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct strong brown (7.5YR 5/8) mottles; moderate medium angular blocky structure; friable; few fine roots; few prominent yellowish brown (10YR 5/4) clay films on faces of peds; many distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; strongly acid; abrupt smooth boundary.

2Btx—27 to 53 inches; yellowish brown (10YR 5/6) silty clay loam; moderate very coarse prismatic structure; very firm; brittle; many distinct grayish brown (10YR 5/2) and common prominent pinkish gray (5YR 6/2) clay films on faces of prisms; common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine black (N 2/0) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

2BC—53 to 64 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct strong brown (7.5YR 5/8) and few faint very pale brown (10YR 7/3) mottles; weak medium subangular blocky structure; friable; common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; strongly acid; clear smooth boundary.

2C1—64 to 70 inches; yellowish brown (10YR 5/4) silt loam; many medium faint very pale brown (10YR 7/3), common medium distinct strong brown (7.5YR 5/8), and common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; strongly acid; clear smooth boundary.

2C2—70 to 80 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light gray (10YR 7/2) and common medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; few medium black (N 2/0) concretions; common fine black (N 2/0) stains (iron and manganese oxide); medium acid.

The thickness of the solum ranges from 40 to 70 inches. The depth to bedrock is more than 60 inches. Depth to the top of the fragipan ranges from 24 to 36 inches. The content of coarse fragments is less than 5 percent in the solum but is as much as 15 percent in the 2C horizon.

The Ap horizon has chroma of 2 or 3. The Bt and 2Btx horizons are silt loam or silty clay loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. The 2Btx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The C horizon has colors similar to those of the Btx horizon. It ranges from sandy loam to clay. It is stratified in some pedons.

Opequon Series

The Opequon series consists of shallow, well drained, moderately permeable or moderately slowly permeable soils. These soils formed in dolomitic limestone residuum on shoulder slopes and dissected side slopes along drainageways in the uplands. Slopes range from 8 to 30 percent.

Opequon soils are commonly adjacent to Bratton, Latham, and Trappist soils. The adjacent soils are moderately deep over bedrock. Bratton soils are on ridgetops and shoulder slopes. Latham soils are on ridgetops and hillsides. Trappist soils are on hillsides.

Typical pedon of Opequon silt loam, 15 to 30 percent slopes, eroded, about 1.25 miles southeast of Sinking Spring, in Mifflin Township; 1,650 feet south-southeast of the intersection of State Route 124 and Nace Corner Road, along Nace Corner Road, then 600 feet west:

Ap—0 to 3 inches; dark brown (7.5YR 4/4) silt loam, light brown (7.5YR 6/4) dry; moderate coarse granular structure; friable; common fine roots; many distinct dark brown (7.5YR 4/2) organic coatings on faces of peds; about 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt1—3 to 10 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; few very fine vesicular pores; many distinct brown (7.5YR 5/4) clay films on faces of peds; few fine black (N 2/0) concretions and stains (iron and manganese oxide); about 10 percent coarse fragments; medium acid; clear wavy boundary.

Bt2—10 to 14 inches; yellowish red (5YR 5/6) clay; weak medium prismatic structure parting to moderate fine subangular blocky; very firm; few fine roots; few very fine vesicular pores; many prominent dark brown (7.5YR 4/4) clay films on faces of peds; common brown (7.5YR 5/4) variegations; common fine black (N 2/0) stains (iron and manganese oxide); slightly acid; clear smooth boundary.

Bt3—14 to 18 inches; reddish brown (5YR 5/4) clay; moderate medium subangular blocky structure; very firm; few very fine roots; few fine vesicular pores; many prominent reddish brown (5YR 4/3) clay films on faces of peds; common fine black (N 2/0) stains (iron and manganese oxide); few yellowish red (5YR 5/6) variegations; very pale brown (10YR 7/4) channery loamy sand with about 20 percent limestone fragments in the bottom 1 inch; slight effervescence in the lower part; neutral; abrupt wavy boundary.

R—18 to 22 inches; hard, massive, dolomitic limestone.

The thickness of the solum and the depth to bedrock range from 12 to 20 inches. The content of coarse fragments increases with increasing depth. It ranges from 0 to 20 percent throughout the subsoil.

The Ap horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or clay. Some pedons have a C horizon. This horizon is 1 to 3 inches thick. It is loamy sand, sandy loam, or the channery analogs of those textures. The content of coarse fragments in this horizon ranges from 2 to 30 percent.

Orrville Series

The Orrville series consists of deep, somewhat poorly drained, moderately permeable soils formed in alluvium. These soils are on narrow flood plains and in the high water channels on broad flood plains. Slopes are 0 to 2 percent.

Orrville soils are commonly adjacent to the well drained Elkinsville, Genesee, and Huntington soils and are similar to Stendal soils. Elkinsville soils are on low stream terraces. Genesee and Huntington soils are in the higher positions on flood plains. Stendal soils have more silt in the upper part than the Orrville soils.

Typical pedon of Orrville silt loam, frequently flooded, about 5 miles northeast of Waverly, in Jackson Township; about 0.5 mile north of the intersection of Higby and Wilson Run Roads, then 30 feet east:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine and common medium roots; strongly acid; abrupt smooth boundary.

C—8 to 14 inches; pale brown (10YR 6/3) silt loam; many medium faint light gray (10YR 7/2), common medium distinct yellowish brown (10YR 5/6), and few medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; common fine roots; few fine vesicular pores; strongly acid; clear wavy boundary.

Cg1—14 to 22 inches; light brownish gray (10YR 6/2) loam; many medium faint light gray (10YR 7/2) and common medium prominent yellowish brown (10YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; medium acid; gradual wavy boundary.

Cg2—22 to 35 inches; light brownish gray (10YR 6/2) loam; many coarse faint light gray (10YR 7/2), common medium prominent brownish yellow (10YR 6/6), and few coarse prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; medium acid; gradual wavy boundary.

C'—35 to 49 inches; yellowish brown (10YR 5/4) clay loam; many coarse distinct light brownish gray (10YR 6/2), and many fine distinct yellowish brown (10YR 5/8), and common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; many fine black (10YR 2/1) concretions (iron and manganese oxide); medium acid; gradual wavy boundary.

Cg—49 to 66 inches; light brownish gray (10YR 6/2) sandy clay loam; many coarse distinct light yellowish brown (10YR 6/4), few medium prominent yellowish brown (10YR 5/6), and few fine prominent yellowish brown (10YR 5/8) mottles; massive; firm; medium acid; gradual wavy boundary.

C''—66 to 80 inches; yellowish brown (10YR 5/6) gravelly sandy clay loam; few fine distinct brownish yellow (10YR 6/8), few medium prominent red (2.5YR 4/6), and common medium prominent grayish brown (10YR 5/2) mottles; massive; friable; about 20 percent gravel; medium acid.

The C horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 2 to 6. It is silt loam, loam, clay loam, sandy clay loam, or gravelly sandy clay loam.

Otwell Series

The Otwell series consists of deep, moderately well drained, very slowly permeable soils. These soils formed in loess and in the underlying outwash on terraces. Slopes range from 0 to 8 percent.

Otwell soils are commonly adjacent to Markland, McGary, Negley, and Taggart soils and are similar to Omulga and Tilsit soils. The adjacent soils do not have a fragipan. Markland and McGary soils are on lacustrine terraces. Negley and Taggart soils are on Illinoian outwash terraces. Omulga soils formed in loess, colluvium, and old alluvium in preglacial valleys. Tilsit soils have a higher content of angular fragments in the lower part than the Otwell soils.

Typical pedon of Otwell silt loam, 3 to 8 percent slopes, about 1.25 miles north-northeast of Cynthiana, in Perry Township; about 6,000 feet southwest of the intersection of State Route 41 and Lapperal Road, along State Route 41, then about 1,300 feet south:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; many fine roots; about 2 percent coarse fragments; medium acid; abrupt smooth boundary.

BA—7 to 11 inches; 70 percent yellowish brown (10YR 5/6) and 30 percent brown (10YR 4/3) silt loam; moderate fine and medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; about 2 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—11 to 16 inches; yellowish brown (10YR 5/6) silt loam; moderate medium and coarse subangular blocky structure; firm; common fine roots; common fine vesicular pores; common faint dark yellowish brown (10YR 4/4) organic coatings on faces of peds; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 2 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—16 to 27 inches; yellowish brown (10YR 5/6) silt loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; common fine vesicular pores; few faint yellowish brown (10YR 5/4) and brown (7.5YR 5/4) clay films on faces of peds; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; few fine and medium very dark grayish brown (10YR 3/2) concretions and stains (iron and manganese oxide); about 2 percent coarse fragments; strongly acid; clear smooth boundary.

Btx1—27 to 34 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct strong brown (7.5YR 5/8) and common fine prominent light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm; few fine roots in vertical cracks; common distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) and very few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common faint light gray (10YR 7/2) silt coatings on faces of peds; few fine very dark grayish brown (10YR 3/2) concretions and stains (iron and manganese oxide); about 2 percent coarse fragments; strongly acid; clear smooth boundary.

Btx2—34 to 50 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct strong brown (7.5YR 5/6) and common medium distinct strong brown (7.5YR 5/8) mottles; strong very coarse prismatic structure parting to moderate thick platy and moderate fine and medium angular blocky; very firm; brittle; common prominent dark yellowish brown (10YR 4/4) and brown (10YR 5/3) and common faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct pale brown (10YR 6/3) and many prominent light brownish gray (10YR 6/2) silt coatings on faces of peds; common medium very dark grayish brown (10YR 3/2) stains (iron and manganese oxide); about 2 percent coarse fragments; strongly acid; gradual wavy boundary.

BC—50 to 80 inches; strong brown (7.5YR 5/6) clay loam; few fine faint brown (7.5YR 5/4) and few fine faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; slightly brittle; few distinct grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) and very few distinct yellowish brown (10YR 5/4) and gray (10YR 5/1) clay films on faces of peds; very few distinct light brownish gray (10YR 6/2) and light gray (10YR 7/1) and common distinct light gray (N 7/0) silt coatings on faces of peds; common coarse very dark grayish brown (10YR 3/2) stains (iron and manganese oxide); about 2 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 45 to 80 inches. The depth to bedrock is more than 60 inches.

Depth to the top of the fragipan ranges from 24 to 36 inches. The content of coarse fragments is less than 5 percent in the solum.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam in the upper part and clay loam in the lower part.

Parke Series

The Parke series consists of deep, well drained, moderately permeable soils on broad outwash plains and terraces. These soils formed in loess and in the underlying Illinoian outwash. Slopes range from 0 to 8 percent.

Parke soils are commonly adjacent to Negley and Taggart soils and are similar to Elkinsville soils. Elkinsville soils have more silt and less sand in the lower part of the subsoil than the Parke soils. Negley soils have more sand in the upper part of the subsoil than the Parke soils. They are on knolls and side slopes. The somewhat poorly drained Taggart soils are in slight depressions on outwash plains and terraces.

Typical pedon of Parke silt loam, 0 to 3 percent slopes, about 1.75 miles northeast of Omega, in Jackson Township; 10,560 feet northeast of the intersection of State Route 335 and Higby Road, along Higby Road, then 2,700 feet south:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine and common medium roots; strongly acid; abrupt smooth boundary.

BA—9 to 15 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; firm; common fine roots; common very fine and few medium vesicular pores; common distinct dark yellowish brown (10YR 4/4) coatings of material from the Ap horizon on faces of peds; medium acid; clear wavy boundary.

Bt1—15 to 27 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few fine roots; common very fine vesicular pores; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—27 to 32 inches; strong brown (7.5YR 5/6) silt loam; moderate coarse subangular blocky structure; firm; common fine vesicular pores; common distinct dark yellowish brown (10YR 4/4) and few distinct yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear irregular boundary.

2Bt3—32 to 40 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate coarse subangular blocky structure; firm; few distinct brown (7.5YR 4/4) and common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; few fine black (N 2/0) stains (iron and manganese oxide); strongly acid; gradual irregular boundary.

2Bt4—40 to 55 inches; strong brown (7.5YR 5/6) gravelly clay loam; weak coarse subangular blocky structure; firm; common prominent brown (7.5YR 4/4) and few distinct yellowish brown (10YR 5/4) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; clear smooth boundary.

2BC—55 to 74 inches; brown (7.5YR 4/4) gravelly loam; weak coarse subangular blocky structure; firm; about 20 percent coarse fragments; strongly acid.

The Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, loam, sandy clay loam, or the gravelly analogs of those textures. The content of coarse fragments ranges from 2 to 20 percent in the 2Bt and 2BC horizons.

Peoga Series

The Peoga series consists of deep, poorly drained, slowly permeable soils formed in loess and slack-water deposits in depressions on Illinoian outwash plains and terraces. Slopes are 0 to 2 percent.

Peoga soils are commonly adjacent to Negley, Parke, and Taggart soils on Illinoian outwash plains and terraces and are similar to Purdy Variant and Taggart soils. Negley and Parke soils are well drained. Purdy Variant soils have more clay in the subsoil than the Peoga soils. Taggart soils are somewhat poorly drained.

Typical pedon of Peoga silt loam, about 2 miles northeast of Waverly, in Jackson Township; 4,000 feet northwest of the intersection of Alma-Omega Road and State Route 335, along Alma-Omega Road, then 100 feet east:

Ap—0 to 12 inches; dark gray (10YR 4/1) silt loam, light gray (10YR 7/1) dry; common medium distinct light olive brown (2.5Y 5/4) mottles in the lower part; moderate coarse granular structure in the upper part and moderate fine subangular blocky structure in the lower part; friable; many very fine roots; medium acid; abrupt smooth boundary.

BEg—12 to 21 inches; light brownish gray (2.5Y 6/2) silt loam; common medium faint light yellowish brown (2.5Y 6/4) and common fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; few very fine vesicular pores; few faint light yellowish brown (10YR 6/4) clay films on faces of peds; common medium and coarse black (N 2/0) concretions; strongly acid; clear wavy boundary.

Btg1—21 to 31 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; few medium roots; few fine vesicular pores; many prominent gray (10YR 5/1) clay films on vertical faces of peds; strongly acid; clear wavy boundary.

Btg2—31 to 41 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; many distinct gray (10YR 5/1) clay films on faces of peds; strongly acid; gradual wavy boundary.

Btg3—41 to 50 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common distinct gray (10YR 5/1) clay films on faces of peds; few fine black (N 2/0) stains (iron and manganese oxide); strongly acid; clear wavy boundary.

BCg—50 to 63 inches; grayish brown (2.5Y 5/2) clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few distinct gray (10YR 5/1) clay films on faces of peds; few fine black (N 2/0) stains (iron and manganese oxide); medium acid; gradual wavy boundary.

Cg—63 to 75 inches; grayish brown (2.5Y 5/2), stratified clay and clay loam; common fine distinct dark gray (10YR 4/1) and common medium prominent yellowish brown (10YR 5/6) mottles; massive; firm; slightly acid.

The thickness of the solum ranges from 48 to 72 inches. The depth to bedrock is more than 60 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. It is silty clay loam or silt loam. The C horizon has colors similar to those of the Bt horizon. It is stratified silty clay loam, clay loam, or clay.

Princeton Series

The Princeton series consists of deep, well drained, moderately permeable soils formed in eolian fine sand and silt on bluffs adjacent to preglacial river valleys. Slopes range from 3 to 30 percent.

Princeton soils are commonly adjacent to Brownsville, Omulga, and Shelocta soils and are similar to Negley soils. Brownsville, Negley, and Shelocta soils have a higher content of coarse fragments in the subsoil than the Princeton soils. Brownsville and Shelocta soils are on hillsides in the uplands. Omulga soils have a fragipan. They are in the preglacial valleys.

Typical pedon of Princeton fine sandy loam, 3 to 8 percent slopes, about 1.5 miles northeast of Piketon, in Seal Township; 2,433 feet north and 150 feet east of southwest corner of sec. 18, T. 5 N., R. 21 W.

Ap—0 to 12 inches; brown (10YR 4/3) fine sandy loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; friable; many very fine roots; slightly acid; abrupt smooth boundary.

BA—12 to 18 inches; brown (7.5YR 5/4) fine sandy loam; moderate fine subangular blocky structure; firm; common very fine roots; few medium vesicular pores; many distinct dark brown (10YR 3/3) organic coatings on vertical faces of peds; few strong brown (7.5YR 5/6) variegations; neutral; clear wavy boundary.

Bt1—18 to 32 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; firm; few very fine roots; few very fine vesicular pores; many distinct dark brown (7.5YR 4/4) clay films on faces of peds; common fine black (N 2/0) stains (iron and manganese oxide); slightly acid; clear wavy boundary.

Bt2—32 to 42 inches; brown (7.5YR 5/4) loam; weak coarse prismatic structure parting to weak medium subangular blocky; firm; many distinct dark brown (7.5YR 4/4) clay films on faces of peds; few strong brown (7.5YR 5/6) variegations; few fine black (N 2/0) stains (iron and manganese oxide); strongly acid; clear wavy boundary.

Bt3—42 to 48 inches; brown (7.5YR 4/4) sandy loam; common fine faint strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; friable; common faint dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear wavv boundary.

BC1—48 to 55 inches; dark brown (7.5YR 4/4), banded fine sandy loam, sandy loam, and loamy sand; weak coarse subangular blocky structure; friable; clay bridges between sand grains; medium acid; clear wavy boundary.

BC2—55 to 66 inches; dark brown (7.5YR 4/4), banded fine sandy loam, sandy loam, and loamy sand; common fine faint brown (7.5YR 5/4) mottles; weak coarse subangular blocky structure; very friable; clay bridges between sand grains; medium acid; clear smooth boundary.

C1—66 to 72 inches; brown (7.5YR 5/4) stratified silt loam and sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; medium acid; gradual wavy boundary.

C2—72 to 86 inches; strong brown (7.5YR 5/6), stratified silt loam and sandy loam; common medium faint brown (7.5YR 5/4) and few fine distinct brownish yellow (10YR 6/6) mottles; massive; friable; medium acid.

The thickness of the solum ranges from 40 to 80 inches. The Ap horizon has chroma of 2 to 4. The Bt horizon has hue of 10YR to 5YR and value and chroma of 4 to 6. It is loam, sandy loam, or sandy clay loam. The C horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is stratified silt loam, loam, or sandy loam.

Purdy Variant

The Purdy Variant consists of deep, poorly drained, slowly permeable soils formed in clayey lacustrine sediments in depressions in preglacial valleys. Slopes are 0 to 2 percent.

Purdy Variant soils are commonly adjacent to McGary, Omulga, and Wyatt soils and are similar to McGary and Peoga soils. McGary, Omulga, and Wyatt soils are on slight rises, knolls, and side slopes in preglacial valleys. McGary soils are somewhat poorly drained. Omulga soils have a fragipan. Wyatt soils are moderately well drained. Peoga soils contain less clay and more silt in the subsoil than the Purdy Variant soils.

Typical pedon of Purdy Variant silt loam, about 1.7 miles southeast of Beaver, in Marion Township; 2,000 feet east and 575 feet south of the center of sec. 11, T. 5 N., R. 20 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; few medium prominent reddish brown (2.5YR 5/4) mottles; weak coarse granular structure; friable; common fine roots; strongly acid; abrupt smooth boundary.

Btg1—8 to 15 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium distinct gray (10YR 6/1) and common fine prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; common fine roots; common fine pores; common faint gray (10YR 6/1) clay films on vertical faces of peds; very strongly acid; clear wavy boundary.

Btg2—15 to 23 inches; grayish brown (2.5Y 5/2) silty clay; few fine faint light olive brown (2.5Y 5/4) and few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; few fine roots; few fine pores; many distinct gray (10YR 5/1) clay films on faces of peds; about 2 percent coarse fragments; extremely acid; gradual wavy boundary.

Btg3—23 to 33 inches; light brownish gray (2.5Y 6/2) silty clay; few medium prominent strong brown (7.5YR 5/8), few fine prominent reddish brown (2.5YR 5/4), and common medium distinct gray (10YR 6/1) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; firm; few very fine roots; many distinct gray (10YR 5/1) clay films on vertical faces of peds; about 2 percent coarse fragments; extremely acid; gradual boundary.

Btg4—33 to 41 inches; gray (10YR 6/1) silty clay; common medium prominent strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure; firm; common faint gray (10YR 5/1) clay films on vertical faces of peds; extremely acid; clear smooth boundary.

BCg—41 to 50 inches; greenish gray (5GY 6/1) clay; few fine prominent light olive brown (2.5Y 5/6) and few fine prominent strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure; few slickensides; very firm; extremely acid; gradual smooth boundary.

Cg—50 to 65 inches; grayish brown (2.5Y 5/2) clay; common medium faint gray (N 5/0), few fine faint light olive brown (2.5Y 5/4), and few fine distinct yellowish brown (10YR 5/6) mottles; massive; very firm; varved; slightly acid; clear smooth boundary.

C—65 to 80 inches; dark yellowish brown (10YR 4/4) clay; many medium prominent greenish gray (5BG 5/1) mottles; massive; firm; varved; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 5 feet.

The Ap horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 2. The Bt horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It has mottles with high chroma. It is silty clay loam, silty clay, or clay. The C horizon has hue of 10YR to 5GY or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 4. It is silty clay or clay.

Rarden Series

The Rarden series consists of moderately deep, moderately well drained and well drained, slowly permeable soils. These soils formed in acid, clayey shale residuum on ridgetops and hillsides in the uplands. Slopes range from 5 to 25 percent.

Rarden soils are commonly adjacent to Blairton, Gilpin, and Shelocta soils and are similar to Coolville and Latham soils. Blairton, Gilpin, and Shelocta soils contain less clay in the subsoil than the Rarden soils. Blairton soils are in positions on the landscape similar to those of the Rarden soils. Gilpin soils are on ridgetops and hillsides. Shelocta soils are on hillsides. Coolville soils are deep over bedrock and have a silty mantle. Latham soils are yellower in the subsoil than the Rarden soils.

Typical pedon of Rarden silt loam, in an area of Blairton-Rarden-Gilpin association, rolling, about 8 miles east of Omega, in Jackson Township; about 850 feet east and 1,200 feet north of the southwest corner of sec. 31, T. 7 N., R. 20 W.

Ap—0 to 6 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; common medium roots; medium acid; abrupt smooth boundary.

BE—6 to 9 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; few very fine vesicular pores; medium acid; clear smooth boundary.

Bt1—9 to 17 inches; strong brown (7.5YR 5/6) silty clay; moderate medium subangular blocky structure; firm; few fine roots; common fine vesicular pores; many distinct brown (7.5YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; gradual smooth boundary.

Bt2—17 to 21 inches; yellowish red (5YR 5/6) clay; many medium prominent light brownish gray (10YR 6/2) mottles; moderate medium angular blocky structure; firm; few fine roots; few fine vesicular pores; many distinct light yellowish brown (10YR 6/4) clay films on faces of peds; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

Bt3—21 to 26 inches; strong brown (7.5YR 5/6) clay; common medium prominent light gray (N 7/0) mottles; weak coarse subangular blocky structure; very firm; few very fine vesicular pores; few faint light yellowish brown (10YR 6/4) clay films on faces of peds; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

Cr—26 to 30 inches; strong brown (7.5YR 5/6) and light gray (N 7/0), thinly bedded, soft shale.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of coarse fragments ranges from 0 to 15 percent in the solum.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silty clay, silty clay loam, or clay. Some pedons have a C horizon, which is channery or shaly silty clay or clay.

Richland Series

The Richland series consists of deep, well drained soils on foot slopes on upland hillsides along the edge of the main preglacial valley in the county. These soils formed in colluvium derived from sandstone and shale and in the underlying clayey old lacustrine sediments. Permeability is moderate in the upper part of the subsoil and slow or very slow in the lower part and in the substratum. Slopes range from 8 to 15 percent.

Richland soils are commonly adjacent to Omulga and Wyatt soils in preglacial valleys and Rarden and Shelocta soils on hillsides in the uplands. Omulga soils have a fragipan. Rarden and Wyatt soils have more clay and fewer coarse fragments in the upper part of the subsoil than the Richland soils. Shelocta soils have less clay in the lower part than the Richland soils.

Typical pedon of Richland silt loam, clayey substratum, 8 to 15 percent slopes, about 3.5 miles east-northeast of Piketon, in Seal Township; 269 feet east and 1,190 feet south of the center of sec. 19, T. 5 N., R. 21 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; many fine roots; patches of light yellowish brown (10YR 6/4); about 5 percent coarse fragments; neutral; abrupt smooth boundary.

AE—4 to 7 inches; light yellowish brown (10YR 6/4) silt loam; moderate fine subangular blocky structure; friable; many fine roots; few fine vesicular pores;

common dark grayish brown (10YR 4/2) coatings of material from the Ap horizon on faces of peds; many faint brown (10YR 5/3) silt coatings on faces of peds; about 5 percent coarse fragments; slightly acid; abrupt smooth boundary.

BE—7 to 12 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; firm; common fine roots; few fine vesicular pores; few faint yellowish brown (10YR 5/4) clay films on faces of peds; many distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

Bt1—12 to 22 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; common fine roots; few medium vesicular pores; many faint yellowish brown (10YR 5/4) clay films on faces of peds; many faint brown (10YR 5/3) silt coatings on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—22 to 31 inches; yellowish brown (10YR 5/4) channery loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; many faint brown (10YR 5/3) clay films on faces of peds; few fine black (10YR 2/1) stains (iron and manganese oxide); about 30 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—31 to 42 inches; yellowish brown (10YR 5/4) channery silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine angular blocky; firm; many distinct grayish brown (10YR 5/2) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; gradual wavy boundary.

2Bt4—42 to 53 inches; yellowish brown (10YR 5/4) channery silty clay; common fine distinct gray (10YR 5/1) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; many distinct light brownish gray (10YR 6/2) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; gradual wavy boundary.

2Bt5—53 to 60 inches; dark brown (7.5YR 4/4) silty clay; few fine prominent gray (10YR 6/1) mottles; weak medium angular blocky structure; very firm; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 2 percent coarse fragments; strongly acid; gradual wavy boundary.

2C1—60 to 69 inches; dark brown (7.5YR 4/4) clay; few fine distinct strong brown (7.5YR 5/6) and common fine distinct dark yellowish brown (10YR 4/4) mottles; massive parting to weak inherited plates (varves); very firm; few fine black (N 2/0) stains (iron and manganese oxide); about 2 percent coarse fragments; strongly acid; gradual wavy boundary.

2C2—69 to 75 inches; dark brown (7.5YR 4/4) clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; massive parting to weak inherited plates (varves); very firm; few fine black (N 2/0) stains (iron and manganese oxide); slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The content of coarse fragments ranges from 5 to 15 percent in the A horizon and the upper part of the Bt horizon, from 20 to 35 percent in the lower part of the Bt horizon, and from 0 to 20 percent in the 2Bt and 2C horizons.

The Ap horizon has chroma of 2 to 4. The Bt and 2Bt horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The Bt horizon is loam, silt loam, silty clay loam, clay loam, or the channery or gravelly analogs of those textures. The 2C horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 3 or 4. It is clay or silty clay.

Rigley Series

The Rigley series consists of deep, well drained, moderately rapidly permeable soils formed in colluvium and residuum derived from coarse grained sandstone and sandstone conglomerate on hillsides in the uplands. Slopes range from 25 to 40 percent.

Rigley soils are commonly adjacent to Blairton, Brownsville, Gilpin, Rarden, and Shelocta soils. Blairton, Gilpin, and Rarden soils are moderately deep over bedrock. Blairton soils are on ridgetops and shoulder slopes. Gilpin and Rarden soils are on ridgetops and hillsides. Brownsville and Shelocta soils are in landscape positions similar to those of the Rigley soils. Brownsville soils have a higher content of coarse fragments in the subsoil than the Rigley soils. Shelocta soils have more silt and less sand in the solum than the Rigley soils.

Typical pedon of Rigley channery fine sandy loam, in an area of Shelocta-Rigley association, steep, about 4 miles east of Omega, in Jackson Township; about 400 feet east and 300 feet north of the center of sec. 29, T. 7 N., R. 20 W.

Oe—2 inches to 0; partially decomposed mixed hardwood leaf litter.

A—0 to 6 inches; dark brown (7.5YR 3/2) channery fine sandy loam, pinkish gray (7.5YR 6/2) dry; strong fine granular structure; very friable; many very fine roots; about 30 percent coarse fragments; medium acid; clear smooth boundary.

BE—6 to 12 inches; strong brown (7.5YR 5/6) gravelly loam; moderate fine subangular blocky structure; firm; common very fine roots; few fine vesicular pores; about 30 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—12 to 22 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; firm; common very fine roots; few fine vesicular pores; many faint brown (7.5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—22 to 31 inches; strong brown (7.5YR 5/6) loam; weak medium subangular blocky structure; firm; few very fine roots; few fine vesicular pores; many distinct brown (7.5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; gradual wavy boundary.

Bt3—31 to 39 inches; brown (7.5YR 5/4) loam; few fine distinct brown (10YR 5/3) mottles; weak medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; many distinct brown (7.5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; gradual wavy boundary.

Bt4—39 to 50 inches; brown (7.5YR 5/4) loam; weak coarse subangular blocky structure; firm; few fine vesicular pores; many distinct brown (7.5YR 4/4) clay films on faces of peds; about 5 percent coarse fragments; strongly acid; abrupt wavy boundary.

C—50 to 60 inches; strong brown (7.5YR 5/8) sand; single grained; loose; about 5 percent coarse fragments; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock ranges from 60 to more than 100 inches. The content of coarse fragments ranges from 15 to 35 percent in the A horizon and from 5 to 35 percent in the B horizon.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. It is loam, sandy loam, or the gravelly or channery analogs of those textures. The C horizon has colors similar to those of the B horizon. It is sand, loamy sand, sandy loam, or the gravelly analogs of those textures.

Shelocta Series

The Shelocta series consists of deep, well drained, moderately permeable soils formed in colluvium and residuum derived from siltstone, sandstone, and shale on hillsides in the uplands. Slopes range from 15 to 40 percent.

Shelocta soils are commonly adjacent to Brownsville, Latham, Rigley, and Trappist soils on hillsides and are similar to Wharton soils. Brownsville soils have a higher content of coarse fragments in the subsoil than the Shelocta soils. The moderately deep Latham and Trappist soils have more clay in the subsoil than the Shelocta soils. Rigley soils have more sand and less silt in the subsoil than the Shelocta soils. Wharton soils are moderately well drained.

Typical pedon of Shelocta channery silt loam, in an area of Trappist-Shelocta association, steep, about 0.5 mile east of Nace Corner, in Mifflin Township; about 3,000 feet east of the intersection of State Route 124 and Nace Corner Road, along State Route 124, then 1,000 feet southeast:

Oe—2 inches to 0; partially decomposed mixed hardwood leaf litter.

A—0 to 3 inches; dark grayish brown (10YR 4/2) channery silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; very friable; common fine roots; about 25 percent coarse fragments; very strongly acid; clear wavy boundary.

E—3 to 14 inches; light yellowish brown (10YR 6/4) channery silt loam; weak fine subangular blocky structure; firm; common very fine roots; common fine vesicular pores; common faint light yellowish brown (10YR 6/4) silt coatings in pores; about 15 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt1—14 to 23 inches; yellowish brown (10YR 5/6) channery silt loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; many faint yellowish brown (10YR 5/6) clay films on faces of peds; about 20 percent coarse fragments; very strongly acid; gradual smooth boundary.

Bt2—23 to 33 inches; yellowish brown (10YR 5/6) channery silt loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; many distinct yellowish brown (10YR 5/6) clay films on faces of peds; about 20 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bt3—33 to 41 inches; brownish yellow (10YR 6/6) very channery silt loam; moderate medium subangular blocky structure; firm; few fine roots; common faint brown (7.5YR 4/4) clay films on vertical faces of peds; many distinct light yellowish brown (10YR 6/4) clay films on faces of peds; about 40 percent coarse fragments; strongly acid; gradual wavy boundary.

Bt4—41 to 52 inches; yellowish brown (10YR 5/6) very channery silt loam; few fine distinct strong brown (7.5YR 5/8) mottles; moderate coarse subangular blocky structure; firm; continuous distinct light yellowish brown (10YR 6/4) clay films on faces of peds; few fine black (N 2/0) stains (iron and manganese oxide); about 40 percent coarse fragments; strongly acid; gradual wavy boundary.

Cr—52 to 54 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8), massive, soft, fine grained sandstone.

R—54 to 58 inches; massive, hard, fine grained sandstone.

The depth to bedrock is more than 48 inches. The thickness of the solum ranges from 40 to 60 inches. The content of coarse fragments is 15 to 30 percent in the solum but can be as much as 45 percent in individual subhorizons of the subsoil.

The A horizon has chroma of 2 to 4. It is silt loam or channery silt loam. The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. It is silt loam, silty clay loam, or the very channery or channery analogs of those textures. Some pedons have a C horizon. This horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is silt loam, silty clay loam, loam, or the channery or very channery analogs of those textures.

Skidmore Variant

The Skidmore Variant consists of deep, well drained, moderately rapidly permeable soils formed in old alluvium on stream terraces and alluvial fans. Slopes range from 0 to 8 percent.

Skidmore Variant soils are commonly adjacent to Clifty, Elkinsville, Haymond, and Shelocta soils. Clifty and Haymond soils are on flood plains. They do not have an argillic horizon. Elkinsville soils have more silt in the subsoil than the Skidmore Variant soils. They are on low stream terraces. Shelocta soils have fewer coarse fragments in the subsoil than the Skidmore Variant soils. They are on foot slopes and side slopes.

Typical pedon of Skidmore Variant gravelly loam, 0 to 3 percent slopes, about 5 miles southwest of Idaho, in Sunfish Township; about 520 feet west of the intersection of Laurel Ridge and Carters Run Roads, along Laurel Ridge Road, then 250 feet south:

Ap—0 to 9 inches; brown (10YR 4/3) gravelly loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; about 25 percent coarse fragments; very strongly acid; clear smooth boundary.

BA—9 to 14 inches; dark brown (7.5YR 4/4) gravelly silt loam; weak fine subangular blocky structure; friable; common fine roots; many fine vesicular pores; common faint brown (10YR 4/3) silt coatings on faces of peds; about 25 percent coarse fragments; very strongly acid; gradual smooth boundary.

Bt1—14 to 25 inches; strong brown (7.5YR 5/6) gravelly silt loam; weak medium subangular blocky structure; firm; few fine roots; common fine vesicular pores; common distinct dark brown (7.5YR 4/4) clay films on faces of peds; about 30 percent coarse fragments; strongly acid; gradual smooth boundary.

Bt2—25 to 35 inches; strong brown (7.5YR 5/6) extremely gravelly loam; weak medium subangular blocky structure; firm; few fine roots; common faint brown (7.5YR 5/4) clay films on faces of peds; about 65 percent coarse fragments; strongly acid; gradual smooth boundary.

C1—35 to 60 inches; brown (7.5YR 5/4) very channery loam; massive; loose; about 45 percent coarse fragments; strongly acid; clear smooth boundary.

C2—60 to 80 inches; yellowish brown (10YR 5/4) very channery loam; massive; loose; about 50 percent coarse fragments; medium acid.

The solum ranges from 30 to 50 inches in thickness. The depth to bedrock is more than 60 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The content of coarse fragments in this horizon ranges from 15 to 35 percent. The Bt horizon has hue of 7.5YR or 10YR and chroma of 4 to 6. It is silt loam, silty clay loam, clay loam, loam, or the gravelly, very gravelly, or extremely gravelly analogs of those textures. The content of coarse fragments in this horizon ranges from 5 to 70 percent. The C horizon has hue of 7.5YR or 10YR and chroma of 4 to 6. It is loam, clay loam, silt loam, silty clay loam, or the channery or very channery analogs of those textures. The content of coarse fragments in this horizon ranges from 5 to 50 percent.

Stendal Series

The Stendal series consists of deep, somewhat poorly drained, moderately permeable soils formed in silty alluvium on flood plains. Slopes are 0 to 2 percent.

Stendal soils are commonly adjacent to Haymond, Melvin, and Wilbur soils and are similar to Orrville soils. The well drained Haymond and moderately well drained Wilbur soils are in the higher positions on flood plains, and the poorly drained Melvin soils are in the lower positions. Orrville soils have more sand in the substratum than the Stendal soils.

Typical pedon of Stendal silt loam, occasionally flooded, about 3.5 miles southwest of Beaver, in Union Township; about 910 feet east and 530 feet south of the northwest corner of sec. 7, T. 5 N., R. 20 W.

Ap—0 to 8 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

C—8 to 14 inches; brown (10YR 5/3) silt loam; common medium faint grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; few fine very dark gray (10YR 3/1) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

Cg1—14 to 20 inches; grayish brown (10YR 5/2) silt loam; many fine faint light brownish gray (10YR 6/2) and common fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; few fine vesicular pores; few fine very dark gray (10YR 3/1) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

Cg2—20 to 33 inches; light brownish gray (10YR 6/2) silt loam; common fine faint pale brown (10YR 6/3) and common fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; few fine vesicular pores; common fine very dark gray (10YR 3/1) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

Cg3—33 to 48 inches; light brownish gray (2.5Y 6/2) silt loam; common coarse prominent yellowish brown (10YR 5/8) and few fine prominent yellowish brown (10YR 5/4) mottles; massive; friable; few fine vesicular pores; strongly acid; gradual smooth boundary.

Cg4—48 to 72 inches; light brownish gray (2.5Y 6/2) silt loam; common medium distinct light olive brown (2.5Y 5/4), common fine prominent yellowish brown (10YR 5/6), and few medium distinct light gray (10YR 7/2) mottles; massive; friable; few fine vesicular pores; strongly acid.

The depth to bedrock is more than 60 inches. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 or 3.

Stonelick Series

The Stonelick series consists of deep, well drained, moderately rapidly permeable soils formed in alluvium on broad flood plains. Slopes are 0 to 2 percent.

Stonelick soils are commonly adjacent to Genesee and Huntington soils are similar to Genesee soils. Genesee and Huntington soils have more clay in the upper part than the Stonelick soils. Huntington soils have a mollic epipedon. They are in the higher positions on the flood plains. Genesee soils are on the broader parts of the flood plains.

Typical pedon of Stonelick loam, occasionally flooded, about 2 miles south of Waverly in Pee Pee Township; about 3,500 feet north of the intersection of Prairie and Boswell Run Roads, then 362 feet west:

Ap—0 to 9 inches; brown (10YR 4/3) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—9 to 12 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; few roots; strong effervescence; mildly alkaline; gradual smooth boundary.

C1—12 to 20 inches; brown (10YR 5/3) sand; single grained; loose; strong effervescence; mildly alkaline; abrupt smooth boundary.

C2—20 to 29 inches; brown (10YR 4/3) sandy loam; massive; friable; strong effervescence; mildly alkaline; clear smooth boundary.

C3—29 to 39 inches; brown (10YR 5/3) sandy loam; massive; very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

Ab—39 to 60 inches; very dark grayish brown (10YR 3/2) silt loam; weak medium subangular blocky structure; friable; neutral.

The depth to bedrock is more than 60 inches. The depth to free carbonates is less than 10 inches. The content of gravel ranges from 0 to 15 percent throughout the profile.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. The C horizon has value of 4 or 5 and chroma of 2 to 4. It is stratified loam, sandy loam, silt loam, loamy sand, or sand.

Taggart Series

The Taggart series consists of deep, somewhat poorly drained, slowly permeable soils. These soils formed in loess and in the underlying outwash in slight depressions on Illinoian outwash plains and in silty old alluvium on low stream terraces. Slopes range from 0 to 4 percent.

Taggart soils are commonly adjacent to Negley, Otwell, Parke, and Peoga soils and are similar to Peoga soils. Negley, Otwell, and Parke soils are in the higher positions on outwash plains and terraces, and Peoga soils are in depressions. Negley and Parke soils are well drained. Otwell soils are moderately well drained and have a fragipan. Peoga soils are poorly drained.

Typical pedon of Taggart silt loam, 0 to 4 percent slopes, about 1.25 miles northeast of Waverly, in Jackson Township; 10,500 feet northeast of the intersection of State Route 335 and U.S. Route 23, along State Route 335, then 2,500 feet north:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; many fine and medium roots; medium acid; abrupt smooth boundary.

BE—9 to 14 inches; brownish yellow (10YR 6/6) silt loam; few fine distinct pale brown (10YR 6/3) and strong brown (7.5YR 5/8) and common coarse distinct brown (10YR 4/3) mottles; moderate fine subangular blocky structure; friable; few fine roots; few very fine tubular pores; few fine black (N 2/0) stains (iron and manganese oxide); strongly acid; clear wavy boundary.

Bt—14 to 26 inches; yellowish brown (10YR 5/6) silt loam; common medium prominent light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; few very fine vesicular pores; few fine black (N 2/0) stains (iron and manganese oxide); very few distinct yellowish brown (10YR 5/4) clay films on faces of peds; common faint light gray (10YR 7/2) silt coatings on faces of peds; about 2 percent coarse fragments; very strongly acid; clear wavy boundary.

Btg—26 to 33 inches; light brownish gray (10YR 6/2) silty clay loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few very fine vesicular pores; common faint yellowish brown (10YR 5/4) and few prominent brown (10YR 5/3) clay films on faces of peds; few faint light gray (10YR 7/2) silt coatings on faces of peds; few coarse fragments; strongly acid; clear wavy boundary.

Bt1—33 to 43 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent light brownish gray (10YR 6/2) and few fine faint strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; few very fine vesicular pores; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; few distinct light gray (10YR 7/2) silt coatings on faces of peds; about 2 percent coarse fragments; strongly acid; clear wavy boundary.

2Bt2—43 to 48 inches; strong brown (7.5YR 5/6) loam; few fine distinct yellowish brown (10YR 5/4) and common fine prominent grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; firm; common faint yellowish brown (10YR 5/4) and few distinct light brownish gray (10YR 6/2) clay films on faces of peds; common prominent brown (10YR 5/3) and few distinct light gray (10YR 7/2) silt coatings on faces of peds; about 2 percent coarse fragments; strongly acid; gradual wavy boundary.

2BC—48 to 72 inches; strong brown (7.5YR 5/6) clay loam; many medium prominent light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; few medium black (N 2/0) stains (iron and manganese oxide); common distinct brown (10YR 5/3) clay films on faces of peds; few faint light gray (10YR 7/2) silt coatings on faces of peds; about 2 percent coarse fragments; strongly acid; clear wavy boundary.

2C—72 to 84 inches; reddish yellow (7.5YR 6/6) sandy clay loam; many coarse faint strong brown (7.5YR 5/6) and few fine distinct very pale brown (10YR 7/3) mottles; single grained; friable; common fine and medium black (N 2/0) stains (iron and manganese oxide); few faint brown (10YR 5/3) and dark yellowish brown (10YR 4/4) clay films on sand grains and coarse fragments; about 10 percent coarse fragments; medium acid.

The Ap horizon has value of 4 or 5 and chroma of 1 or 2. The Bt horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 2 to 6. It is silty clay loam or silt loam. The 2B and 2C horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. They are clay loam, loam, sandy loam, sandy clay loam, silty clay loam, or the gravelly analogs of those textures. In some pedons the content of gravel in strata below a depth of 5 feet is as much as 30 percent.

Tilsit Series

The Tilsit series consists of deep, moderately well drained soils formed in loess and in the underlying material weathered from siltstone and sandstone. These soils are on broad ridgetops in the uplands. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 0 to 4 percent.

Tilsit soils are commonly adjacent to Coolville, Gilpin, and Rarden soils and are similar to Omulga and Otwell soils. Coolville, Gilpin, and Rarden soils do not have a fragipan. Coolville soils are on ridgetops and shoulder slopes. Gilpin and Rarden soils are on ridgetops and hillsides. Omulga soils do not have thin, flat stone fragments in the lower part. Otwell soils have glacial pebbles within a depth of 40 inches.

Typical pedon of Tilsit silt loam, 0 to 4 percent slopes, about 2.15 miles north-northeast of Idaho, in Pebble Township; about 300 feet south of the intersection of Newland Ridge and Newland Hill Roads, then 2,400 feet west:

Ap—0 to 7 inches, dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak fine granular structure; friable; common medium roots; neutral; abrupt smooth boundary.

Bt1—7 to 17 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; firm; common fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; few fine very dark gray (10YR 3/1) stains (iron and manganese oxide); very strongly acid; clear smooth boundary.

Bt2—17 to 27 inches; yellowish brown (10YR 5/4) silt loam; common medium faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; few fine vesicular pores; common distinct grayish brown (10YR 5/2) clay films on faces of peds; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Btx1—27 to 35 inches; yellowish brown (10YR 5/6) silt loam; few fine faint yellowish brown (10YR 5/8) and common fine faint yellowish brown (10YR 5/4) mottles; weak very coarse prismatic structure parting to weak medium subangular blocky; very firm; brittle; few fine roots; few very fine pores; common prominent grayish brown (10YR 5/2) clay films on vertical faces of peds; few distinct dark brown (7.5YR 4/4) clay films on faces of peds; common distinct gray (10YR 6/1) silt coatings on faces of peds; very strongly acid; gradual wavy boundary.

2Btx2—35 to 41 inches; yellowish brown (10YR 5/6) silty clay loam; common fine faint yellowish brown (10YR 5/4) mottles; weak very coarse prismatic structure parting to moderate medium platy; very firm; brittle; common prominent grayish brown (10YR 5/2) clay films on vertical faces of peds and common prominent yellowish brown (10YR 5/4) clay films on faces of peds; few faint gray (10YR 6/1) silt coatings on faces of peds; about 5 percent coarse fragments; very strongly acid; gradual wavy boundary.

2Btx3—41 to 51 inches; yellowish brown (10YR 5/6) silty clay loam; few coarse faint yellowish brown (10YR 5/8) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; very firm; brittle; few prominent gray (10YR 5/1) clay films on vertical faces of peds and common prominent dark brown (7.5YR 4/4) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

2C—51 to 54 inches; yellowish brown (10YR 5/4) channery silty clay loam; few fine distinct gray (10YR 5/1), few fine faint yellowish brown (10YR 5/6), common medium distinct grayish brown (10YR 5/2), and common coarse distinct yellowish brown (10YR 5/8) mottles; massive; very firm; about 20 percent coarse fragments; very strongly acid; abrupt smooth boundary.

2R—54 to 58 inches; hard, fine grained sandstone.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock ranges from 40 to 65 inches. Depth to the top of the fragipan is 18 to 28 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt and Btx horizons are silt loam or silty clay loam. The Bt horizon has value of 4 or 5 and chroma of 4 to 6. The Btx horizon has value of 5 or 6 and chroma of 4 to 6. The C horizon has chroma of 4 to 6. It is silt loam, silty clay loam, or the channery analogs of those textures.

Trappist Series

The Trappist series consists of moderately deep, well drained, moderately slowly permeable soils formed in residuum and colluvium derived from acid, fissile shale and sandstone on side slopes and foot slopes in the uplands. Slopes range from 15 to 40 percent.

Trappist soils are commonly adjacent to Brownsville, Latham, Omulga, and Shelocta soils and are similar to Latham soils. Brownsville, Omulga, and Shelocta soils are deep over bedrock. Brownsville and Shelocta soils are on hillsides. Omulga soils are in preglacial valleys. Latham soils are moderately well drained and are on ridgetops and hillsides.

Typical pedon of Trappist silt loam, in an area of Trappist-Shelocta association, steep, about 0.35 mile east of Nace Corner, in Mifflin Township; about 0.35 mile east of the intersection of State Route 124 and Nace Corner Road, along State Route 124, then 750 feet southeast:

Oe—2 inches to 0; partially decomposed mixed hardwood leaf litter.

A—0 to 3 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common medium roots; about 2 percent shale and sandstone fragments; very strongly acid; clear smooth boundary.

BE—3 to 9 inches; light yellowish brown (10YR 6/4) silt loam; weak fine subangular blocky structure; firm; few medium and many fine roots; many fine vesicular pores; about 2 percent shale and sandstone fragments; very strongly acid; clear smooth boundary.

Bt1—9 to 17 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; few medium and common fine roots; few fine vesicular pores; many faint brown (7.5YR 5/4) clay films on faces of peds; about 5 percent shale and sandstone fragments; very strongly acid; gradual wavy boundary.

Bt2—17 to 24 inches; yellowish red (5YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; few fine vesicular pores; many distinct brown (7.5YR 4/4) clay films on faces of peds; about 25 percent shale fragments; very strongly acid; gradual wavy boundary.

Bt3—24 to 31 inches; yellowish red (5YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; many prominent brown (7.5YR 4/4) clay films on faces of peds; about 30 percent shale fragments; very strongly acid; gradual wavy boundary.

Bt4—31 to 37 inches; yellowish red (5YR 5/6) channery silty clay; few medium faint yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; many prominent brown (7.5YR 4/4) clay films on faces of peds; about 30 percent shale fragments; very strongly acid; gradual wavy boundary.

Cr—37 to 46 inches; yellowish red (5YR 5/6), highly weathered, thinly bedded, soft shale; common medium faint yellowish red (5YR 4/6) mottles; firm; few fine roots; medium continuous brown (7.5YR 4/4) coatings in partings; clear smooth boundary.

R—46 to 50 inches; variegated dark reddish brown (5YR 3/2), yellowish red (5YR 5/8), and reddish brown (5YR 5/4), clayey shale.

The depth to paralithic or lithic contact ranges from 20 to 40 inches. The thickness of the solum is generally the same as depth to bedrock, but it is less in some pedons.

The A horizon has chroma of 2 to 4. The Bt horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 4 to 8. It is silty clay loam, silty clay, clay, or the channery or shaly analogs of those textures. The content of coarse fragments in this horizon ranges from 5 to 35 percent.

Wernock Variant

The Wernock Variant consists of moderately deep, moderately well drained, moderately permeable soils on narrow ridgetops in the uplands. These soils formed in loess and in the underlying shale residuum. Slopes range from 3 to 8 percent.

Wernock Variant soils are commonly adjacent to Coolville, Gilpin, Rarden, and Tilsit soils and are similar to Coolville soils. Coolville and Rarden soils have more clay in the subsoil than the Wernock Variant soils. Gilpin soils have a higher content of sand and coarse fragments in the subsoil than the Wernock Variant soils. Coolville soils are on ridgetops and shoulder slopes. Gilpin and Rarden soils are on ridgetops and hillsides. The deep Tilsit soils are on the broader ridgetops. They have a fragipan.

Typical pedon of Wernock Variant silt loam, 3 to 8 percent slopes, about 5.3 miles southwest of Idaho, in Sunfish Township; about 2,600 feet west-southwest of the intersection of Laurel Ridge and Alexander Roads, along Laurel Ridge Road, then 600 feet north-northeast:

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common fine roots; about 2 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bt1—8 to 17 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; few fine vesicular pores; common faint brown (7.5YR 5/4) clay films on faces of peds; about 2 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—17 to 24 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; many distinct yellowish brown (10YR 5/4) clay films on faces of peds; about 2 percent coarse fragments; very strongly acid; clear wavy boundary.

2Bt3—24 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6) and many medium distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; few fine vesicular pores; many distinct light brownish gray (10YR 6/2) clay films on faces of peds; about 2 percent coarse fragments; very strongly acid; gradual smooth boundary.

2Bt4—32 to 38 inches; yellowish brown (10YR 5/4) silty clay; common fine faint strong brown (7.5YR 5/6) and many medium distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; few fine vesicular pores; common distinct light brownish gray (10YR 6/2) clay films on faces of peds; about 2 percent coarse fragments; extremely acid; clear smooth boundary.

Cr—38 to 42 inches; yellowish brown (10YR 5/6), brownish yellow (10YR 6/8), and light gray (10YR 7/2), soft shale.

The solum ranges from 30 to 40 inches in thickness. The content of coarse fragments ranges from 0 to 10 percent in the solum.

The A horizon has value of 3 or 4 and chroma of 2 to 4. The Bt and 2Bt horizons have hue of 10YR or 7.5YR and chroma of 4 to 6. The Bt horizon is silt loam or silty clay loam. The Cr horizon is typically soft, weathered shale, but it is weathered sandstone or siltstone in some pedons.

Wharton Series

The Wharton series consists of deep, moderately well drained, moderately slowly permeable or slowly permeable soils. These soils formed in residuum and colluvium derived from siltstone, shale, and fine grained sandstone on hillsides in the uplands. Slopes range from 15 to 25 percent.

Wharton soils are commonly adjacent to Gilpin, Latham, and Rarden soils and are similar to Blairton, Gilpin, and Shelocta soils. Blairton, Gilpin, Latham, and Rarden soils are moderately deep over bedrock. Gilpin and Shelocta soils are well drained. Gilpin, Latham, and Rarden soils are on ridgetops and hillsides.

Typical pedon of Wharton silt loam, in an area of Latham-Wharton silt loams, 15 to 25 percent slopes, about 2 miles west-southwest of Jasper, in Newton Township; about 2,240 feet east of the intersection of Long Fork and Smokey Hollow Roads, along Long Fork Road, then about 250 feet south:

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many medium roots; about 2 percent coarse fragments; medium acid; abrupt smooth boundary.

Bt1—5 to 10 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; firm; few fine roots; few fine vesicular pores; few faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct brown (10YR 5/3) silt coatings on faces of peds; about 2 percent coarse fragments; medium acid; clear smooth boundary.

Bt2—10 to 20 inches; strong brown (7.5YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; many distinct brown (7.5YR 5/4) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; gradual boundary.

Bt3—20 to 32 inches; yellowish brown (10YR 5/6) channery silty clay loam; few medium prominent gray (10YR 6/1) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very firm; few fine roots; few fine vesicular pores; many prominent light brownish gray (10YR 6/2) clay films on faces of peds; about 15 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt4—32 to 40 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct gray (10YR 6/1) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; few fine roots; few fine vesicular pores; many prominent light olive brown (2.5Y 5/4) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; gradual smooth boundary.

Bt5—40 to 48 inches; light olive brown (2.5Y 5/4) silty clay; few medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; very firm; few very fine vesicular pores; many distinct grayish brown (2.5Y 5/2) clay films on faces of peds; few medium black (10YR 2/1) stains (iron and manganese oxide); about 10 percent coarse fragments; very strongly acid; gradual smooth boundary.

C—48 to 66 inches; light olive brown (2.5Y 5/4) silty clay; few medium faint light olive brown (2.5Y 5/6) and many medium distinct grayish brown (2.5Y 5/2) mottles; massive; very firm; about 10 percent coarse fragments; very strongly acid.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock is more than 40 inches. The content of coarse fragments ranges from 0 to 15 percent in the Ap horizon and from 2 to 20 percent in the Bt and C horizons.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. The B horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. It is silt loam, silty clay loam, clay loam, silty clay, or the channery analogs of those textures. The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is silt loam, clay, or the channery analogs of those textures.

Wilbur Series

The Wilbur series consists of deep, moderately well drained, moderately permeable soils formed in silty alluvium on flood plains in preglacial valleys. Slopes are 0 to 2 percent.

Wilbur soils are commonly adjacent to Melvin and Stendal soils and are similar to the well drained Genesee and Haymond soils. The poorly drained Melvin and somewhat poorly drained Stendal soils are in the slightly lower positions on the flood plains.

Typical pedon of Wilbur silt loam, occasionally flooded, about 3 miles southwest of Beaver, in Union Township; 1,100 feet north of the intersection of State Route 124 and Red Hollow Road, along Red Hollow Road, then 395 feet east:

Ap—0 to 8 inches brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

C1—8 to 14 inches; dark yellowish brown (10YR 4/4) silt loam; few fine distinct yellowish brown (10YR 5/6) and few fine faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; slightly acid; clear wavy boundary.

C2—14 to 21 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct grayish brown (10YR 5/2) and common fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine vesicular pores; slightly acid; clear wavy boundary.

C3—21 to 29 inches; yellowish brown (10YR 5/4) silt loam; common fine distint grayish brown (10YR 5/2), few fine distinct dark brown (7.5YR 4/4), and common fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine vesicular pores; medium acid; clear wavy boundary.

Cg1—29 to 46 inches; grayish brown (10YR 5/2) silt loam; few fine distinct yellowish brown (10YR 5/4), few medium prominent dark brown (7.5YR 4/4), and few fine distinct grayish brown (2.5Y 5/2) mottles; weak coarse subangular blocky structure; friable; few fine vesicular pores; thin bedding planes; few fine black (N 2/0) concretions; strongly acid; gradual wavy boundary.

Cg2—46 to 58 inches; grayish brown (10YR 5/2) silt loam; common medium prominent dark brown (7.5YR 4/4) and common fine faint light brownish gray (10YR 6/2) mottles; massive; firm; thin bedding planes; common fine black (N 2/0) concretions; strongly acid; gradual wavy boundary.

Cg3—58 to 66 inches; grayish brown (10YR 5/2) silt loam; many medium prominent reddish brown (5YR 4/4) mottles; massive; firm; thin bedding planes; common fine black (N 2/0) concretions; strongly acid.

The depth to bedrock is more than 60 inches. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The C horizon has value of 4 to 6 and chroma of 2 to 6.

Wyatt Series

The Wyatt series consists of deep, moderately well drained, slowly permeable or very slowly permeable soils on knolls, hillsides, and side slopes in preglacial valleys. These soils formed in lacustrine sediments. Slopes range from 3 to 15 percent.

Wyatt soils are commonly adjacent to Doles, Omulga, Richland, and Wilbur soils and are similar to Markland soils. Doles and Omulga soils have less clay in the subsoil than the Wyatt soils and have a fragipan. They are commonly in the less sloping, slightly lower areas. Markland soils have carbonates in the subsoil. Richland soils have a higher content of sand and coarse fragments in the upper part of the subsoil than the Wyatt soils. They are on foot slopes. Wilbur soils have less clay throughout than the Wyatt soils. They are on flood plains.

Typical pedon of Wyatt silty clay loam, 3 to 8 percent slopes, eroded, about 8.25 miles east-southeast of Givens, in Beaver Township; 800 feet south of the intersection of Beaver Pike and Straight Creek Road, along Straight Creek Road, then 500 feet west:

Ap—0 to 6 inches; dark yellowish brown (10YR 4/4) silty clay loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; friable; few fine roots; specks of yellowish brown (10YR 5/6) subsoil material; strongly acid; abrupt smooth boundary.

Bt1—6 to 13 inches; yellowish brown (10YR 5/6) silty clay loam; weak medium subangular blocky structure; firm; few very fine roots; common faint yellowish brown (10YR 5/4) and common distinct pale brown (10YR 6/3) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—13 to 17 inches; yellowish brown (10YR 5/6) silty clay; few fine prominent light gray (10YR 7/2) mottles; moderate medium subangular blocky structure; firm; common distinct light yellowish brown (10YR 6/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt3—17 to 27 inches; yellowish brown (10YR 5/6) silty clay; few fine prominent light brownish gray (10YR 6/2) mottles; moderate medium and fine subangular blocky structure; firm; common prominent light brownish gray (10YR 6/2) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt4—27 to 36 inches; yellowish brown (10YR 5/6) clay; few fine prominent light brownish gray (10YR 6/2) mottles; weak coarse and medium subangular blocky structure; very firm; common prominent dark yellowish brown (10YR 4/4) and few prominent light brownish gray (10YR 6/2) clay films on faces of peds; few olive gray (5Y 4/2) faces on slickensides; strongly acid; gradual wavy boundary.

Bt5—36 to 40 inches; yellowish brown (10YR 5/6 and 5/4) clay; few fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; very firm; few very fine roots; common distinct dark yellowish brown (10YR 4/4) and common prominent light brownish gray (10YR 6/2) clay films on faces of peds; many fine black (N 2/0) stains (iron and manganese oxide); common olive gray (5Y 4/2) slickensides; strongly acid; gradual smooth boundary.

C1—40 to 48 inches; yellowish brown (10YR 5/6 and 5/4) clay; common fine distinct light brownish gray (10YR 6/2) mottles; massive; very firm; varved; common olive gray (5Y 4/2) slickensides; medium acid; clear smooth boundary.

C2—48 to 64 inches; variegated yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4), varved clay, silty clay, and silt loam; massive; very firm; common olive gray (5Y 4/2) faces on slickensides; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 36 to 60 inches. The depth to carbonates ranges from 36 to more than 100 inches. The depth to bedrock is more than 60 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 6. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is stratified silty clay, clay, silty clay loam, or silt loam.

Formation of the Soils

This section relates the major factors of soil formation to the soils in Pike County and explains some of the processes of soil formation.

Factors of Soil Formation

Soils form through the actions of weathering and biotic activity on rock and unconsolidated soil material deposited or accumulated through geologic activity. The major factors of soil formation are parent material, climate, relief, living organisms, and time.

The physical and chemical composition of the parent material affects the kind of soil that forms. Climate and living organisms, particularly vegetation, are the active forces of soil formation. Their effect on the parent material is modified by relief and by the length of time that the parent material has been acted upon. Relief modifies the effects of climate and vegetation, mainly through its influence on runoff and temperature. Time is needed for a soil to form in the parent material. Generally, a long period is required for the development of distinct soil horizons. The relative importance of each factor differs from place to place. In places one factor dominates and determines most of the soil properties, but normally the interaction of all five factors determines what kind of soil forms in any given place.

Parent Material

The soils in Pike County formed in several kinds of parent material: colluvium, residuum, loess, lacustrine deposits, old alluvium, glacial outwash, glacial till, and recent alluvium. Commonly, loess covers most of the other kinds of parent material. In some areas colluvium overlies lacustrine deposits or residual material. In other areas glacial till overlies residuum.

Colluvium is material weathered from bedrock and soil material on side slopes and foot slopes. The colluvium in Pike County weathered from shale, siltstone, and sandstone. It is the most extensive parent material in the county. Ernest soils are among the soils that formed in colluvium.

Some of the soils in Pike County formed in varying amounts of colluvium over residuum. The upper part of the subsoil formed in colluvium, and the lower part of the subsoil and the substratum formed in residuum. The colluvium weathered from shale, siltstone, and sandstone has moved downslope. The lower part of the subsoil formed in shale, siltstone, and sandstone residuum. Examples of soils formed in colluvium and residuum are Blairton, Brownsville, Latham, Rigley, Shelocta, Trappist, and Wharton soils.

A few soils formed in colluvium and in the underlying lacustrine deposits. The colluvium moved downslope from the adjacent hillsides. It weathered from a mixture of shale and sandstone. Richland soils formed in these parent materials.

The soils on ridgetops in the uplands formed in bedrock residuum. Many of these soils formed in as much as 35 inches of loess, which overlies the residuum. Bratton, Tilsit, and Wernock Variant are examples of soils that formed in loess and the underlying residuum.

Shale and dolomitic limestone residuum is fine textured. Rarden soils formed mainly in shale residuum. Opequon soils formed in dolomitic limestone residuum. The material weathered from interbedded shale, siltstone, and sandstone is medium textured or moderately fine textured. The lower part of the subsoil and the substratum in Blairton soils formed in this material. Siltstone and sandstone residuum is moderately fine textured to moderately coarse textured. The lower part of the subsoil in Gilpin and Brownsville soils formed in this material.

Some of the soils in Pike County formed in fine textured lacustrine deposits mantled with a thin layer of loess. In some areas the loess mantle has been removed by erosion. The lacustrine deposits are mainly in former and present stream valleys. They were deposited when stream outlets were blocked. The layered silty and clayey characteristics of the parent material are reflected in a fine textured, plastic subsoil. Purdy Variant and Wyatt are examples of soils that formed in fine textured lacustrine deposits.

Some soils formed in loess, colluvium, or old alluvium underlain by stratified lacustrine sediments. These soils are in valley fills in the abandoned preglacial Teays River drainage system. Both the old alluvium and colluvium are derived from weathered acid shale, siltstone, and sandstone. The colluvium is from the higher lying soils and bedrock formations in the county. The old alluvium is from the surface layer of other soils and from bedrock outcrops in unglaciated areas. Soils that formed in these materials have a fragipan. The fragipan generally is in the loess or colluvium. It is in the old alluvium, however, in areas that have no colluvium. This fragipan commonly is not so well expressed where the colluvium is thinner or has a higher content of clay than is typical. Omulga and Doles soils formed in these parent materials.

Some soils formed in old alluvium weathered from sandstone and shale. These soils are on hillsides along drainageways in the preglacial Teays River Valley. Allegheny Variant soils formed in this material.

Recent alluvium, which is deposited by floodwater, is the youngest parent material in the county. It is still accumulating as fresh sediment deposited during periods of stream overflow. The sediment is derived from the surface layer of the higher lying soils. Clifty, Genesee, Haymond, Huntington, Melvin, Orrville, Stendal, Stonelick, and Wilbur soils and the upper part of Montgomery Variant soils formed in alluvium.

Older alluvial deposits on low stream terraces and alluvial fans are slightly higher than the present flood plains. The soils in these landscape positions have a well developed subsoil. The alluvium was deposited at a much earlier time, during periods of very high stream overflow. Elkinsville, Martinsville, and Skidmore Variant soils and the rarely flooded Taggart soils that have a surface layer of silt loam formed in old alluvium.

Some of the soils in Pike County formed in glacial material of the Wisconsian or Illinoian age. This material consists of glacial drift, loess, and silty and clayey lacustrine material. It covers local bedrock formations.

Glacial drift includes till and glacial outwash. Glaciers generally transported debris for only short distances; therefore, the soils for the most part formed in glacial drift derived from nearby bedrock formations. The dominant source of the glacial till in the county is Ross County to the north. Only about 10 to 15 percent of the rock fragments in the glacial till are from igneous rocks that have their source in either Canada or the northeastern part of the United States.

Wisconsinan glacial till is the only till in the county. Miamian soils formed in this till. Miami Variant soils formed in Wisconsinan glacial till and in acid shale residuum.

Outwash of sand and gravel was deposited by glacial water that flowed in the glacial streams, especially the Scioto River. This coarse textured material was fairly well sorted by the water. Fox soils formed in loamy glacial outwash over outwash of sand and gravel. Negley soils formed in meltwater deposits of the Illinoian age.

Princeton soils formed in eolian fine sand and silt on bluffs adjacent to the Scioto River Valley. This part of the river valley was a preglacial valley.

Climate

The climate in Pike County is uniform. As a result, it has not greatly contributed to differences among the soils. It has favored physical changes and chemical weathering of the parent material and the activity of living organisms. Rainfall has leached the subsoil of the carbonates in the parent material of many upland and terrace soils. Because of this leaching, Omulga and Doles soils have an acid subsoil. Wyatt soils have been leached of carbonates to a depth of 36 to more than 100 inches. The frequency of rainfall resulted in wetting and drying cycles that favored the translocation of clay minerals and the formation of the soil structure common in most of the soils in Pike County.

The range of temperature variations has favored both physical changes and chemical weathering of the parent material. Freezing and thawing aided the formation of soil structure. Warm summer temperatures favored chemical reactions in the weathering of primary materials. Both rainfall and temperature have favored plant growth and the accumulation of organic matter in all the soils in the county.

Relief

Relief and parent material influence the drainage characteristics of soils. Two soils that formed in the same kind of parent material can have different drainage characteristics. Generally, soils in the higher areas are better drained than soils in low areas. Omulga and Doles soils, for example, formed in similar kinds of parent material in preglacial valleys. Omulga soils are at the slightly higher elevations and are moderately well drained, whereas Doles soils are in slight depressions and are somewhat poorly drained. The water table in the Doles soils is at a depth of 1 to 2 feet during wet periods, whereas the one in the Omulga soils is generally at a depth of 2.0 to 3.5 feet.

Relief also influences horizon development. Soils on broad ridgetops are relatively stable. As water in these soils leaches elements, translocates clay, and aids in the weathering of bedrock, strongly differentiated horizons form. Soils on steep hillsides are not in stable positions and are prone to hillside slippage and erosion. Rainfall can run off before it penetrates the surface. As a result, distinct horizons do not form.

Living Organisms

Living organisms are active forces of soil formation. Vegetation influences the amount of organic matter and exchangeable bases in the soil. Soils that formed under mixed prairie vegetation and trees, such as Huntington soils, have a thick, dark A horizon. Grass roots and blades die and decompose yearly, resulting in an accumulation of organic matter. The content of exchangeable bases, such as calcium, magnesium, and potassium, is high in soils that formed under grasses.

Soils that formed under hardwood forest vegetation do not have a high content of organic matter and have a lower content of exchangeable bases than grassland soils. Trees replenish the soils only with an annual leaf fall. The trees themselves live for many years. Therefore, these soils have less organic matter and a thin, dark A horizon. The type of trees in an area also influences the soil. Soils under oak trees are more acid than soils under yellow-poplar trees. Oak leaves are acidic, are generally tannic, and have a low content of plant nutrients. In contrast, yellow-poplar leaves have a higher content of plant nutrients and a lower content of organic acids. As leaves decompose, the nutrients and acids are released in the soil. Leaves of oak trees release tannic acid and few bases. As a result, nutrients are leached from the soil and the pH level is lowered. Leaves of yellow-poplar trees release exchangeable bases, which help to maintain the higher pH and fertility levels.

Soil is the habitat of many micro-organisms, which aid in the decomposition of organic matter, such as crop residue and leaves. Fungi are generally more important in soils that have a low pH level, whereas bacteria are more important in neutral or alkaline soils. Burrowing animals, insects, and earthworms incorporate organic matter into the lower horizons. Their channels increase the porosity of the soils.

Human activities also have influenced soil formation. Tillage has accelerated the decomposition of organic matter and has increased the susceptibility to erosion. Drainage systems in some areas and irrigation systems in others have altered the soils. Soil material has been removed or added on construction sites and in surface-mined areas. The conversion of forest to cropland also has influenced soil formation. Additions of lime and fertilizer have altered the natural fertility of the soils.

Time

The age of a soil is indicated to some extent by the degree of horizon differentiation. Generally, the longer the time that climate and plants and animals act on parent material, the more distinct the horizons in the soil profile. In many places factors other than time have been responsible for the differences among soils. If the parent material weathers slowly, the soil also forms slowly.

Most of the soils in Pike County are old and have well developed profiles. The oldest soils formed in residuum and colluvium. Soils influenced by the Illinoian and Wisconsinan Glaciations, such as Negley and Fox soils, are younger than the residual and colluvial soils, but they still have strongly developed horizons. Soils on flood plains, such as Genesee and Haymond soils, are young and show little evidence of horizon development.

Processes of Soil Formation

Most of the soils in Pike County have strongly expressed profiles. The processes of soil formation have resulted in very distinct changes in the soils. The strongest development is evident in the soils on ridgetops and hillsides in the uplands, the soils on lacustrine and outwash terraces, and the soils that formed in old alluvial and lacustrine deposits in the Teays River Valley. In contrast, the soils on flood plains have been only slightly modified by the processes of soil formation.

The soil-forming processes are additions, removals, transfers, and transformations *(14)*. Some processes promote differences among the surface layer, subsoil, and substratum, whereas other processes retard or destroy differences that are already evident. The processes are caused by basic chemical and physical interactions, such as oxidation, reduction, hydration, hydrolysis, solution, eluviation (leaching), and illuviation (accumulation) *(14)*.

The most important addition to the soils in Pike County is the addition of organic matter to the surface layer. Some organic matter accumulates in a thin layer under woodland vegetation. If the soil is cleared and cultivated, this organic matter is destroyed. Severe erosion can remove all evidence of this addition to the soil. Other additions include the deposition of sediment and the accumulation of nutrients and colloidal material from such sources as organic matter, ground water, lime, and fertilizers. Some nutrients move in a cycle from the soil to the plant and then back to the soil as by-products of organic matter decomposition. This process occurs in all of the soils in the county, except for those in areas where the cycle is modified by cropping. Alluvial soils, such as Clifty, Genesee, Haymond, Huntington, Melvin, Stonelick, and Wilbur soils, periodically receive sediment deposited by floodwater.

Leaching of carbonates from calcareous parent material is one of the most significant losses preceding many other chemical changes in the soils. Wyatt soils are an example of soils that have been partly leached of carbonates. They have carbonates at a depth of 36 to more than 100 inches. Other soils that may be deep to carbonates are the Negley and Parke soils. Most of the other soils in the uplands no longer have carbonates within 5 feet of the surface and are medium acid to extremely acid in the subsoil.

Following the removal of carbonates, the alteration of such minerals as biotite and feldspar changes the color of the subsoil. Free iron oxides are produced. If the iron oxides are segregated by a fluctuating high water table, the soils have grayish colors and are mottled. This process has occurred in Melvin, Stendal, Purdy Variant, and Peoga soils. Brownish colors characterize most of the soils in the county. Exceptions are Doles, Omulga, Tilsit, and other soils in which the water table is seasonally high because of a restricting layer or fragipan.

Seasonal cycles of wetting and drying in the soil are largely responsible for the transfer of clay from the surface layer to the faces of peds in the subsoil. The fine clay is suspended in water percolating through the surface layer and then is deposited in the subsoil. This transfer accounts for the clay films on faces of peds in the subsoil of most of the soils on uplands, terraces, and valley fills in Pike County.

The transformation of mineral compounds occurs in most soils. The results of this process are most apparent if the formation of layers is not affected by rapid erosion or by the accumulation of material at the surface. The primary silicate minerals are weathered chemically to produce secondary minerals, mainly layer lattice silicate clays, most of which remain in the subsoil.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled typography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

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.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

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. 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.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The depth of the soil over bedrock. Deep soils are more than 40 inches deep over bedrock; moderately deep soils, 20 to 40 inches; and shallow soils, 10 to 20 inches.

Depth to rock (in tables). Bedrock is too near the surface for 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 they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

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 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

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.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material.

Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

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 overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

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).

Munsell notation. A designation of color by degrees of 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. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

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.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Perimeter drains. A drain installed around the perimeter of a septic tank absorption field to lower the water table. Also called a curtain drain.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity, expressed as pH values, are—

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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called 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.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

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 surface runoff.

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.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

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.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

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 water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and control erosion.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.