United States
Department of
Agriculture

Soil
Conservation
Service

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

Soil Survey of Perry County, Ohio

HOW TO USE

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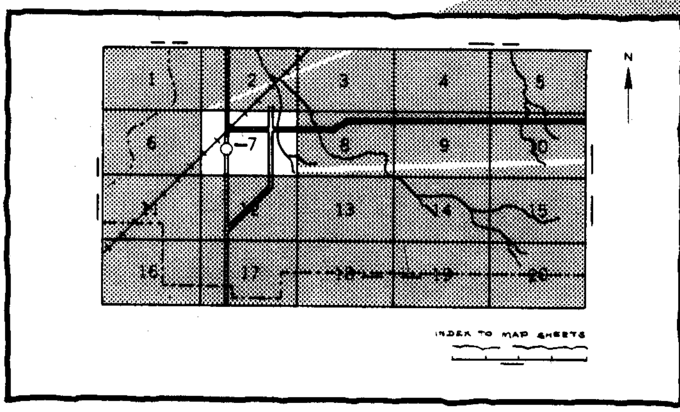

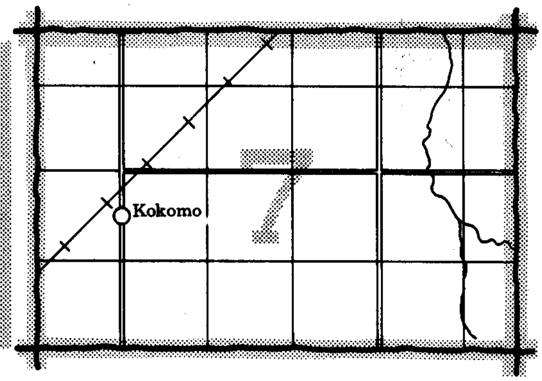

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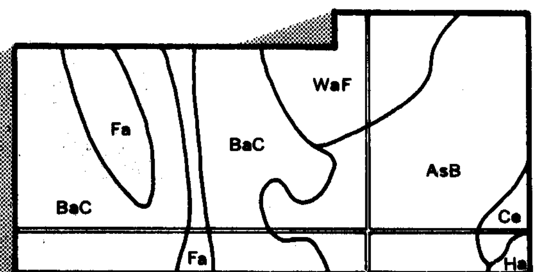

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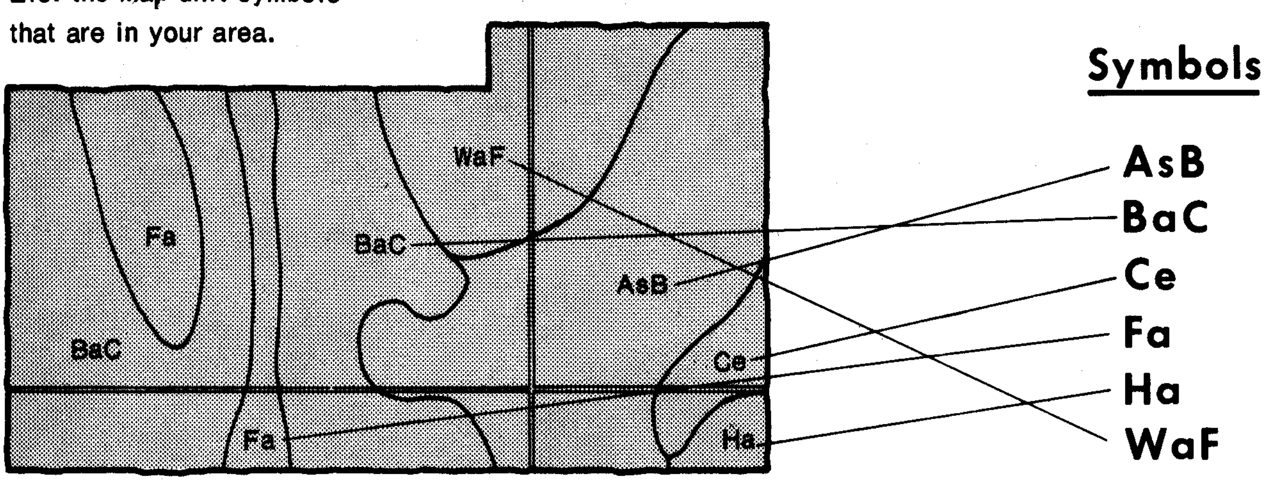
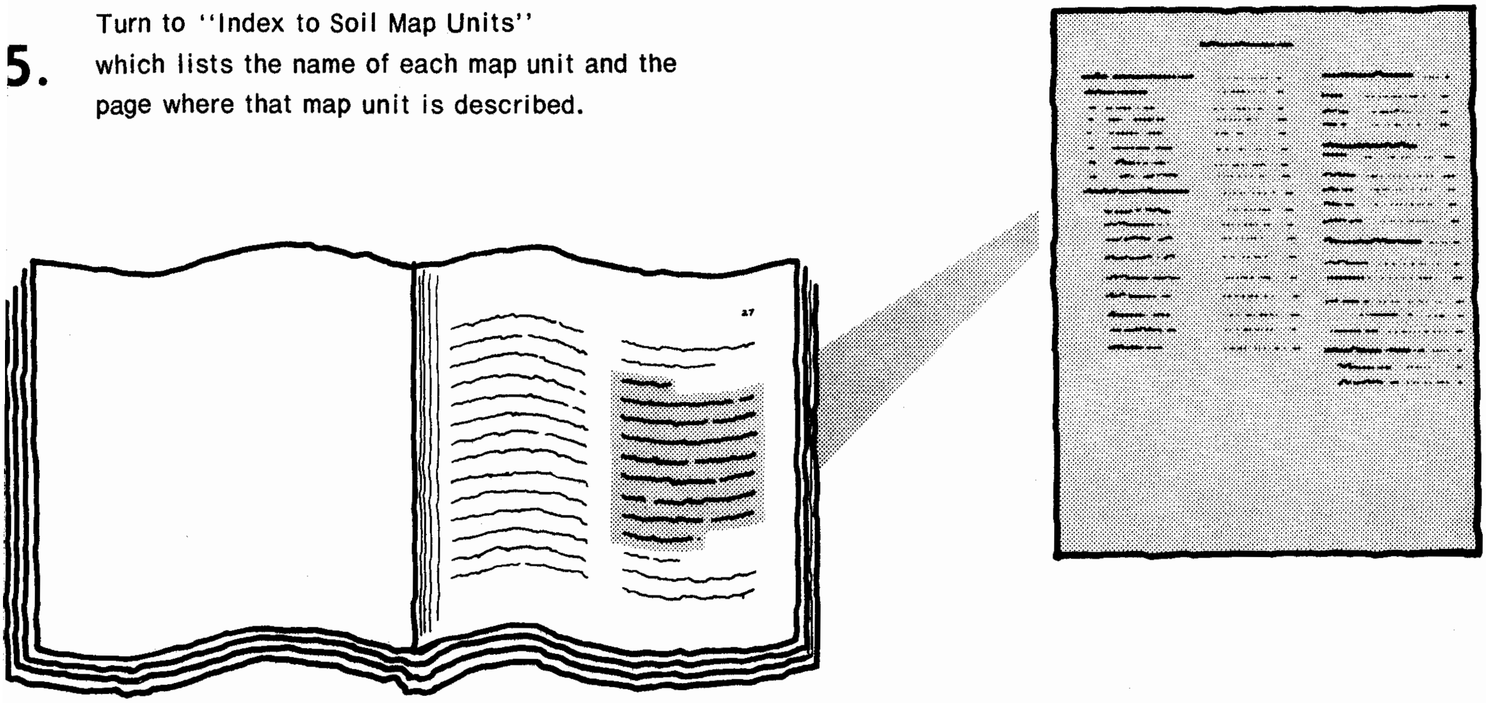
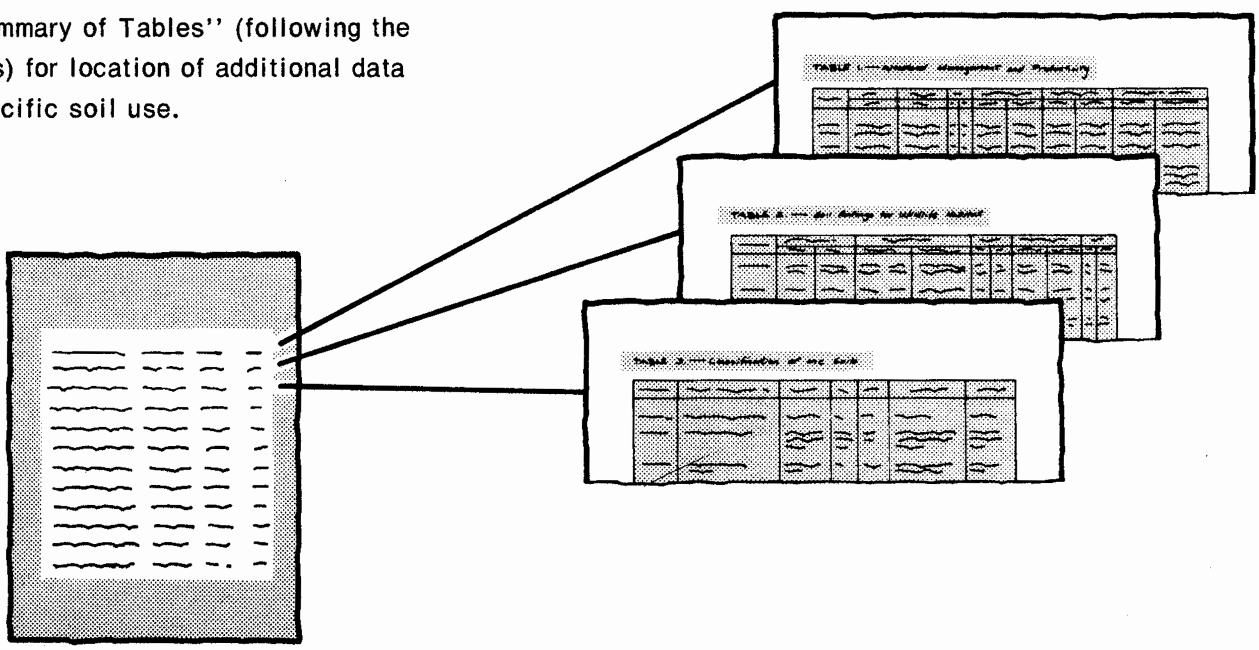


HIS SOIL SURVEY

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



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



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

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

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 Forest 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 Perry Soil and Water Conservation District. Financial assistance was provided by the Perry County Commissioners.

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

Cover: A farmstead in an area of Mentor soils. Killbuck soils are in the depressions.

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Foreword

This soil survey contains information that can be used in land-planning programs in Perry 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 water table near the surface 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.

Harry W. Oneth
State Conservationist
Soil Conservation Service

Soil Survey of
Perry County, Ohio

By Neil Rubel and Paul Jenny, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the Forest Service; 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

Perry County is in the southeastern part of Ohio (fig. 1). The total area is 262,080 acres, or 410 square miles. In 1980, the population was 31,032. New Lexington, the only city, is the county seat. It had a population of 5,179 in 1980. The larger towns include Roseville, Crooksville, Thornville, Glenford, Somerset, Junction City, Shawnee, Corning, and New Straitsville.

Figure 1.—Location of Perry County in Ohio.

Climate

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

Perry County is cold in winter and fairly warm in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. The normal annual precipitation is adequate for all 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 New Lexington, Ohio, in the period 1951 to 1980. 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 30 degrees F, and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at New Lexington on January 28, 1963, is -26 degrees. In summer the average temperature is 71 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, about 23 inches, or nearly 60 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 17 inches. The heaviest 1-day rainfall during the period of record was 3.70 inches at New Lexington on January 14, 1968. Thunderstorms occur on about 42 days each year. Tornadoes and severe thunderstorms occur occasionally. These storms are usually local in extent and of short duration and cause damage in scattered areas.

The average seasonal snowfall is about 29 inches. The greatest snow depth at any one time during the period of record was 25 inches. On the average, 21 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 60 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 10 miles per hour, in spring.

Physiography, Relief, and Drainage

The topography of Perry County includes three general sections. These sections coincide with the part of the county affected by the Wisconsinan Glaciation, about 14,000 to 28,000 years ago; the part affected by the Illinoian Glaciation, about 300,000 years ago; and the unglaciated part of the county (*7*).

The Wisconsinan glacier covered the northwestern part of the county. This section includes most of Thorn Township and a small part of Reading Township. It generally is gently sloping or strongly sloping. East and south of this area is the section affected by the Illinoian glacier. This section is dominantly gently sloping on the broader ridgetops and strongly sloping and moderately steep on the side slopes. It makes up about one-third of the county. The unglaciated area makes up about half of the county. It is south and east of the area affected by the Illinoian glacier. It is on narrow, strongly sloping and moderately steep ridgetops and on steep and very steep side slopes.

The glaciated part of the county is drained mostly by Jonathan Creek, which flows east into the Muskingum River, and by Rush Creek, which flows west into the Hocking River. The unglaciated part is drained by Rush Creek to the west, by Moxahala Creek, which flows north into the Muskingum River, and by the Sunday and Monday Creeks, which flow south into the Hocking River.

The highest point in the county is approximately 1,200 feet above sea level. It is in an area between Somerset and Junction City. The lowest point is about 700 feet above sea level. It is along Sunday Creek, south of Corning.

Geology

The preglacial landscape in the northern and western parts of Perry County probably was similar to the present landscape south of these areas (*7*). The advance of the Illinoian glacier was marked by only a partial leveling of ridgetops. Exposed bedrock and residual soils on the highest part of the Illinoian landscape indicate that the Illinoian glacier moved into preglacial valleys as a mudflow. The glacier left thick deposits of glacial till in the lowest part of the valleys and thinner deposits near the top of side slopes and on ridgetops.

In contrast, the Wisconsinan glacier leveled the remaining unglaciated ridgetops. It filled old valleys with very thick deposits of additional glacial till and left a smoother landscape in Thorn Township and part of Reading Township.

Exposed bedrock in the county ranges in age from the Osage Series of the Mississippian System to the Conemaugh Series of the Pennsylvanian System. Only part of the Mississippian System is in Perry County. It consists mainly of the upper 100 feet of the Vinton member of the Logan Formation, which is the oldest bedrock outcrop. The overlying Maxville Limestone is discontinuous because of erosion. The Mississippian rocks are exposed in the deeper valleys that are not covered with glacial till. These valleys are in the western part of the county.

The Pottsville Group overlies the Mississippian rocks. It is exposed mainly in the northern and western parts of the county. It either is at higher elevations than the Illinoian glacial till or is in areas where the glacial till has been eroded or was never deposited. The Pottsville Group is also exposed on the lower slopes along the lower reaches of Butcherknife Creek, Buckeye Fork, and Moxahala Creek. Quakertown coal has been mined in the north-central part of the county. Tionesta and Middle Mercer clays are important in the manufacture of ceramic products.

Most of the rocks exposed in the central part of the county are of the Allegheny Group. This group also includes some of the rocks on the lower slopes along Sunday Creek and the West Branch of Sunday Creek. The Lower and Middle Kittanning and Upper Freeport coalbeds are in the Allegheny Group. Other important deposits are Brookville and Lower Kittanning clays, which are used in the manufacture of ceramic products.

The lower half of the Conemaugh Group is in Perry County. It includes the youngest bedrock formations in the county. These rocks are exposed in the southeastern third of the county. Conemaugh coal and the clay layers in the Conemaugh Series are unimportant economically. Brush Creek Limestone has been quarried and used as base material for roads.

History

Mound Builders once inhabited this survey area. Later, the Shawnee, Delaware, and Wyandot Indians hunted throughout the area, but they lived along the Scioto and Muskingum Rivers.

In 1801, the first permanent settlement in the survey area was established near New Reading, in Reading Township. The early settlers came mainly from Pennsylvania, Virginia, Maryland, New York, and New Jersey.

In 1817, Perry County was formed from parts of Washington, Fairfield, and Muskingum Counties (*8, 10, 13*). It was named after Oliver Hazard Perry, a hero of the War of 1812. Somerset was the first county seat. In 1857, the county seat was moved to New Lexington. The present courthouse was built in 1887.

About 1870, the mining of coal and iron ore began and the population in the southern part of the county increased rapidly. Until recently, there were numerous pottery, tile, and brick manufacturing plants in the county. The mining of coal, including surface mining, has also slowed in recent years.

Natural Resources

Perry County is a source of many mineral deposits, including sandstone, limestone, clay, shale, ironstone, flint or chert, coal, oil, and gas. Coal was mined extensively in the past. It still is mined but on a smaller scale (*7*). Oil and gas production has increased in recent years. The use of clay and shale for pottery and in tile factories has declined dramatically in recent years. Massillon Sandstone, which was once quarried for building stone, is now quarried mostly for use as industrial sand and in pottery making. Maxville Limestone is quarried near Somerset for cut stone. It is quarried near Maxville for use as base material for roads.

Farming and Other Land Uses

Since 1900, the acreage used for farming has steadily decreased. In 1967, about 28 percent of the county was cropland, including hayland (*12*). About 13 percent was pastured, and about 45 percent was used as woodland. The remaining 14 percent was used for other purposes.

In 1982, there were 750 farms in the county. These farms averaged about 140 acres in size. Most were family owned (*6*).

The most important sources of farm income are beef cattle, corn, and dairy cows (*4*). Hogs, sheep, soybeans, wheat, and hay also are important sources. Farming is gradually shifting to large cash-grain enterprises that specialize in the production of corn, soybeans, and wheat. A few full-time farmers specialize in dairy and beef cattle. Part-time farming is common throughout the county. It includes enterprises that raise beef cattle and some hogs and sheep. It also includes hay production. Fruits and vegetables are grown on a small acreage in the county. They are marketed locally at roadside stands or farmers' markets. A few greenhouses and nurseries are throughout the county.

The southern part of the county has more than 16,000 acres of unreclaimed surface-mined areas. The State of Ohio administers the Perry Reclamation Area, near Rehoboth. This area is managed for off-road recreational vehicles and hunting. Though most of the woodland in the county is privately owned, about 18,307 acres in the southern part is owned by the Forest Service. This land is part of the Wayne National Forest.

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 Soils 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 and a description of the geology of Perry County (*7*) were among the references used.

Before the fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs, which were taken in 1977 at a scale of 1:38,000 and enlarged to a scale of 1:15,840. U.S.

Geologic Survey topographic maps, at a scale of 1:24,000, helped the soil scientists to relate land and image features.

Soil scientists traversed the surface on foot, examining the soils. In areas of the Centerburg-Amanda association and other areas where the soil pattern is very complex, traverses were spaced as close as 200 yards. In very steep areas of the Westmoreland-Guernsey-Zanesville association and other areas where land use is less intensive, traverses were spaced about 0.25 mile apart.

As they traversed the surface, the soil scientists divided the landscape into segments based on the use and management of the soils. For example, a hillside would be separated from a terrace and a gently sloping ridgetop from a strongly sloping side slope. In most areas soil examinations along the traverses were made at points 100 to 300 yards apart, depending on the landscape and soil pattern.

Observations of such items as landforms, blown-down trees, vegetation, roadbanks, bedrock highwalls in surface-mined areas, and animal burrows were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. With the aid of a 3/4-inch-diameter soil sampling tube, a bucket auger, or a spade, the soil material was examined to a depth of about 4 feet or to bedrock within a depth of 4 feet. Deeper soils were examined to a depth of 8 feet or more with the aid of a truck-mounted, hydraulic soil coring rig. The pedons described as typical were observed and studied in pits that were dug with backhoes, shovels, spades, and spud bars.

Soil mapping was recorded on mylars or film positives of the 1977 photobase maps. 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 then mapped. Extensive notes were taken on the composition of the map units in these preliminary study areas. These notes were modified as mapping progressed and a final assessment of the composition of the individual map units was made. Some transects were made to determine the composition of soil complexes, especially the Homewood-Westmoreland and Guernsey-Westmoreland complexes.

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 of 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 on 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 the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association 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 association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

1. Westmoreland-Bethesda-Guernsey Association

Nearly level to very steep, well drained and moderately well drained soils formed in colluvium and residuum derived from sandstone, siltstone, shale, and limestone and in mine spoil; on uplands

This association is mainly on narrow, rounded ridgetops and on hillsides. The ridgetops are about 150 to 500 feet wide and are convex. Some ridges have high knolls. The hillsides generally are moderately steep to very steep. Typically, however, they have one or two narrow benches that are less steep. Mine spoil ridges and clifflike bedrock highwalls are distinctive features of the landscape in most areas. The spoil ridges commonly are 25 to 100 feet high. In some areas the top of the ridges has been graded. The bedrock highwalls are commonly 50 to 100 feet high and are several hundred feet to several miles long. Long, narrow water impoundments are at the base of some of the highwalls. Slope ranges from 0 to 70 percent. The maximum local relief is 150 to 250 feet in most areas.

This association makes up about 38 percent of the county. It is about 25 percent Westmoreland soils, 20 percent Bethesda soils, 20 percent Guernsey soils, and 35 percent soils of minor extent.

The strongly sloping to very steep Westmoreland and Guernsey soils commonly occur as alternating strips on ridgetops and hillsides. The well drained Westmoreland soils are commonly on the more sloping parts of the landscape, and the moderately well drained Guernsey soils are on benches and in slightly concave areas. The nearly level to very steep, well drained Bethesda soils are on spoil ridges in surface-mined areas.

Westmoreland soils are moderately permeable. Available water capacity is low or moderate.

Bethesda soils are moderately slowly permeable. Available water capacity is low.

Guernsey soils are moderately slowly permeable or slowly permeable. Available water capacity is moderate. A seasonal high water table is at a depth of 24 to 42 inches. The shrink-swell potential is high in the lower part of the profile. The steeper areas of these soils are subject to hillside slippage.

Of minor extent in this association are the Wellston, Zanesville, Dekalb, Newark, and Nolin soils. Wellston and Zanesville soils have more silt in the upper part than the major soils. They are on ridgetops. The moderately deep Dekalb soils are on hillsides. Newark and Nolin soils formed in alluvium on flood plains.

Most of this association is used as woodland or is reverting to woodland. Some areas have been cleared of trees. About three-fourths of the cleared land is used for hay, corn, wheat, or pasture. The rest is idle land. Most of the farmed areas are on the ridgetops and flood plains.

The less sloping Guernsey and Westmoreland soils are better suited to most uses than the Bethesda soils. They are moderately well suited to cultivated crops and well suited to pasture. The moderately steep to very steep Guernsey and Westmoreland soils are poorly suited or generally unsuited to cultivated crops because of the slope, a severe hazard of erosion, and droughtiness. The strongly sloping to very steep Guernsey and Westmoreland soils are moderately well suited to woodland.

The Bethesda soils are dominantly unreclaimed and are limited by droughtiness, the slope, and the hazard of erosion. They are generally unsuited to cropland. Unless reclaimed, they are generally unsuited or poorly suited to pasture.

Most of the houses in areas of this association are on ridgetops. The less sloping soils are moderately well suited or poorly suited to buildings and septic tank absorption fields. The steeper soils are generally unsuited to these uses. The slope is the main limitation. The moderately slow or slow permeability, the high shrink-swell potential, and the hazard of slippage are additional problems in areas of the Guernsey soils.

2. Cincinnati-Alford-Westmoreland Association

Gently sloping to moderately steep, well drained soils formed in loess, glacial till, and residuum and colluvium derived from siltstone, sandstone, and shale; on uplands

This association is on plane or slightly convex ridgetops and side slopes and, to a lesser extent, on benches and in coves at the head of drainageways. Slope ranges from 1 to 25 percent. The maximum local relief is 100 to 200 feet in most areas.

This association makes up about 32 percent of the county. It is about 35 percent Cincinnati soils, 10 percent Alford soils, 10 percent Westmoreland soils, and about 45 percent soils of minor extent.

The gently sloping to strongly sloping Cincinnati soils are dominantly on the narrower ridgetops and on side slopes. In some areas they are on benches and in coves. They formed in loess and in the underlying Illinoian glacial till. A fragipan is at a depth of about 24 to 36 inches. It restricts air and water movement and root growth. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Available water capacity is moderate. A seasonal high water table is at a depth of 30 to 48 inches.

The gently sloping to moderately steep Alford soils are on the wider ridgetops, on benches, and in coves. They formed in thick deposits of loess. Permeability is moderate. Available water capacity is high.

The strongly sloping and moderately steep Westmoreland soils are mainly on side slopes. They formed in residuum and colluvium derived from siltstone, sandstone, and shale. Permeability is moderate. Available water capacity is low or moderate.

Of minor extent in this association are the Dekalb, Fitchville, Glenford, Guernsey, Homewood, Killbuck, and Newark soils. The moderately deep Dekalb soils are on hillsides. Fitchville and Newark soils are somewhat poorly drained. Glenford and Guernsey soils are moderately well drained. Homewood soils are well drained and moderately well drained. Killbuck soils are poorly drained. Fitchville and Glenford soils are on terraces and in old glacial lake basins. Guernsey and Homewood soils are on ridgetops and side slopes. Killbuck and Newark soils are on flood plains.

Most of this association is used as cropland and pasture. Corn, wheat, and hay are the main crops. Narrow bands on the steeper slopes and near drainageways commonly are used as woodlots. The less sloping soils are well suited or moderately well suited to cropland, but the steeper soils are poorly suited. The slope and the hazard of erosion are the main problems in the areas used for row crops or small grain. The silt loam surface layer of the major soils crusts after heavy rains. Deep-rooted legumes on the Alford and Cincinnati soils are subject to frost heaving. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to control erosion.

The Alford and Westmoreland soils are better suited to building site development than the Cincinnati soils. The slope of all three soils is a limitation. Other limitations are the moderately slow or slow permeability and seasonal wetness of the Cincinnati soils and the bedrock at a depth of more than 40 inches in the Westmoreland soils.

3. Westmoreland-Guernsey-Zanesville Association

Gently sloping to very steep, well drained and moderately well drained soils formed in loess and in residuum and colluvium derived from sandstone, siltstone, shale, and limestone; on uplands

This association is on convex, narrow ridgetops and on dissected side slopes. The ridgetops are commonly about 200 to 400 feet wide and are plane or convex. They have low knolls. Slope ranges from 3 to 70 percent. The maximum local relief is 150 to 250 feet in most areas.

This association makes up about 18 percent of the county. It is about 30 percent Westmoreland soils, 30 percent Guernsey soils, 10 percent Zanesville soils, and 30 percent soils of minor extent.

The strongly sloping to very steep, well drained Westmoreland soils are on ridgetops and the steeper, more convex parts of hillsides. Permeability is moderate. Available water capacity is low or moderate.

The strongly sloping to very steep, moderately well drained Guernsey soils are typically on the less sloping, concave parts of hillsides. Permeability is moderately slow or slow. Available water capacity is moderate. A seasonal high water table is at a depth of 24 to 42 inches. The shrink-swell potential is high in the lower part of the profile. The steeper areas of these soils are subject to hillside slippage.

The gently sloping to strongly sloping, moderately well drained Zanesville soils are on ridgetops. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Available water capacity is moderate. A seasonal high water table is at a depth of 24 to 36 inches during extended wet periods.

Of minor extent in this association are the well drained Wellston soils on ridgetops, the moderately deep Dekalb soils on hillsides, and the somewhat poorly drained Newark soils on flood plains. Wellston soils have more silt in the upper part of the subsoil than the Westmoreland and Guernsey soils and do not have a fragipan.

Most of this association is woodland or is idle land that is reverting to woodland. The gently sloping and strongly sloping soils on the wider ridgetops are used as cropland or pasture. Hay, corn, and wheat are the main crops. All of the major soils are moderately well suited to woodland. The steeper soils are poorly suited or generally unsuited to cropland, hay, and pasture. The less sloping soils are moderately well suited or well suited to these uses. The slope and the hazard of erosion are the main concerns in managing cropland and woodland.

The steeper soils are generally unsuitable as sites for buildings and septic tank absorption fields. The slope of the Westmoreland and Guernsey soils and the hazard of slippage, moderately slow or slow permeability, and high shrink-swell potential of the Guernsey soils are the main limitations. The less sloping soils are moderately well suited or poorly suited to buildings and septic tank absorption fields. The seasonal wetness and moderately slow or slow permeability of the Guernsey and Zanesville soils and the high shrink-swell potential of the Guernsey soils are the main limitations.

4. Centerburg-Amanda Association

Gently sloping to moderately steep, moderately well drained and well drained soils formed in glacial till; on uplands

This association is on undulating ground moraines and end moraines characterized mainly by slight rises, knolls, and ridges. The moraines have a well defined drainage pattern and a few closed depressions. Streams are small. Slope ranges from 2 to 18 percent. The maximum local relief ranges from about 40 to 150 feet.

This association makes up about 6 percent of the county. It is about 45 percent Centerburg soils, 35 percent Amanda soils, and 20 percent soils of minor extent.

The gently sloping, moderately well drained Centerburg soils are on ground moraines and on low rises on end moraines near the head of drainageways. Permeability is moderately slow. Available water capacity is moderate or high. A seasonal high water table is at a depth of 18 to 36 inches.

The gently sloping to moderately steep, well drained Amanda soils are on narrow ridges, the higher knolls, and side slopes having a deeply entrenched drainage pattern. Permeability is moderately slow. Available water capacity is moderate or high.

Of minor extent in this association are the somewhat poorly drained Bennington and very poorly drained Pewamo soils in the lower positions on till plains and the poorly drained Killbuck soils on flood plains.

Nearly all of this association is used as cropland. Corn, soybeans, wheat, and hay are the chief crops. A small acreage is used as pasture. The uncleared acreage consists of small woodlots of mixed hardwoods. The less sloping soils are well suited to cropland and pasture. The steeper soils are poorly suited or moderately well suited to these uses. All of the major soils are well suited to woodland. The hazard of erosion and the slope are the main limitations affecting farming. A system of conservation tillage that leaves crop residue on the surface and grassed waterways are commonly used to control erosion on cropland.

The less sloping Amanda soils are better suited to building site development than the Centerburg soils. The slope of the steeper Amanda soils is a limitation. The slope of the steeper Amanda soils, the moderately slow permeability of both the major soils, and the seasonal wetness of the Centerburg soils are limitations on sites for septic tank absorption fields.

5. Zanesville-Wellston-Westmore Association

Gently sloping to strongly sloping, moderately well drained and well drained soils formed in loess and in the underlying material weathered from sandstone, siltstone, shale, and limestone; on uplands

This association is on broad, slightly convex ridgetops and wide, slightly lower benches. Slope ranges from 1 to 15 percent. The maximum local relief is 150 to 200 feet in most areas.

This association makes up about 1 percent of the county. It is about 30 percent Zanesville soils, 15 percent Wellston soils, 15 percent Westmore soils, and 40 percent soils of minor extent.

The moderately well drained Zanesville soils are commonly on the wider, more even ridgetops. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Available water capacity is moderate. A seasonal high water table is at a depth of 24 to 36 inches during extended wet periods.

The well drained Wellston soils are on the narrower ridgetops and near breaks to side slopes. Permeability is moderate, and available water capacity is high.

The well drained Westmore soils are on ridgetops and benches. Permeability is moderate in the upper part of the profile and moderately slow or slow in the lower part. Available water capacity is moderate or high. The shrink-swell potential is high in the lower part of the profile.

Of minor extent in this association are the moderately steep to very steep Guernsey and Westmoreland soils on ridgetops and hillsides and the very steep Brownsville soils on hillsides. The minor soils have a lower content of silt and a higher content of clay or coarse fragments in the upper part of the profile than the major soils.

The soils in this association are used mainly as cropland or pasture. They are well suited or moderately well suited to cropland and woodland and are well suited to pasture. The main management concerns are the hazard of erosion, the slope, and the restricted internal water movement and root growth in the fragipan of the Zanesville soils. Stands of deep-rooted crops, such as alfalfa, are difficult to maintain because of a high potential for frost action.

The soils in this association are well suited or moderately well suited to buildings and are moderately well suited or poorly suited to septic tank absorption fields. The Wellston soils are better suited to these uses than the Westmore and Zanesville soils. The slope of all the major soils, the moderately slow or slow permeability in the Zanesville and Westmore soils, the high shrink-swell potential in the Westmore soils, and the seasonal wetness in the Zanesville soils are the main limitations.

6. Killbuck-Luray-Mentor Association

Nearly level to strongly sloping, poorly drained, very poorly drained, and well drained soils formed in alluvium, lacustrine sediments, and glacial outwash; on flood plains and terraces and in old glacial lake basins

This association is on flats, slope breaks, and the rolling parts of flood plains, terraces along streams and old glacial lake basins. The combined width of the flood plains and terraces across the valleys ranges from about 500 to 5,000 feet. Differences in elevation are generally less than 10 feet. In most places the landscape gradually rises from the flood plains to the terraces. In some areas the flood plains and terraces are separated by short, steep slopes. Slope ranges dominantly from 0 to 15 percent.

This association makes up about 3 percent of the county. It is about 25 percent Killbuck soils, 20 percent Luray soils, 15 percent Mentor soils, and 40 percent soils of minor extent.

The nearly level, poorly drained Killbuck soils formed in recent alluvium over a buried soil. They are on flood plains and are frequently flooded. A seasonal high water table is near the surface during extended wet periods. Permeability is moderately slow, and available water capacity is high.

The nearly level, very poorly drained Luray soils formed in lacustrine sediments on terraces along streams and in old glacial lake basins. They are subject to ponding. A seasonal high water table is near or above the surface during extended wet periods. Permeability is moderately slow, and available water capacity is high.

The gently sloping to strongly sloping, well drained Mentor soils formed in silty deposits and in the underlying glacial outwash. They are on stream terraces. Permeability is moderate, and available water capacity is high.

Of minor extent in this association are the Ockley, Euclid, and Nolin soils. Ockley soils have more sand in the upper part than the major soils. They are on terraces. The somewhat poorly drained Euclid soils are on low stream terraces. Nolin soils formed in recent alluvium on flood plains.

Most of this association is used as cropland. Some of the undrained and more frequently flooded areas are used as pasture or woodland or are idle. The soils are well suited or moderately well suited to cropland and woodland. The frequent flooding, the ponding, the slope, and the erosion hazard are the major management concerns. The slope and the erosion hazard limit the use of the Mentor soils for row crops. The Luray soils can be drained more easily than the Killbuck soils. As a result, they are more extensively drained. Undrained areas of the Killbuck and Luray soils are suited to habitat for wetland wildlife.

Most of the buildings in areas of this association are on the Mentor soils. Because of the flooding, the ponding, and the moderately slow permeability, the Killbuck and Luray soils are generally unsuitable as sites for buildings and septic tank absorption fields. The Mentor soils are well suited or moderately well suited to these uses.

7. Peoga-Newark Association

Nearly level, poorly drained and somewhat poorly drained soils formed in lacustrine sediments, loess, and alluvium; on low terraces and flood plains

This association is on low, wide terraces and on flood plains that commonly are narrow. The terraces are between the flood plains and slope breaks to the uplands. Slope is 0 to 2 percent. Differences in elevation are generally less than 20 feet.

This association makes up about 2 percent of the county. It is about 45 percent Peoga soils, 45 percent Newark soils, and 10 percent soils of minor extent.

The poorly drained Peoga soils formed in lacustrine sediments and loess on low stream terraces. They are subject to rare flooding. Permeability is slow. Available water capacity is high. A seasonal high water table is near the surface during extended wet periods.

The somewhat poorly drained Newark soils formed in recent alluvium on flood plains. They are frequently flooded. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 6 to 18 inches during extended wet periods.

Of minor extent in this association are the moderately well drained Glenford soils on the slightly higher terraces.

Nearly all of this association has been cleared. About two-thirds of the cleared acreage is used for soybeans and some corn. The rest is used mainly for pasture and hay. A small acreage near abandoned stream meanders is used as woodland. The association is moderately well suited to pasture and is moderately well suited or poorly suited to cropland. The slow permeability of the Peoga soils and the susceptibility to flooding and seasonal wetness of both the major soils are the main limitations. The crops that can be planted after the normal flooding period should be selected for planting. These soils are well suited to woodland and are well suited or moderately well suited to habitat for wetland wildlife.

The soils in this association are generally unsuitable as sites for buildings and septic tank absorption fields. The slow permeability of the Peoga soils and the seasonal wetness and susceptibility to flooding of both the major soils are the main limitations.

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 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, Alford silt loam, 1 to 8 percent slopes, is a phase in the Alford series.

Some map units are made up of two or more major soils. These map units are called soil complexes. *A soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Guernsey-Westmoreland silt loams, 15 to 25 percent slopes, is an example.

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

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

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

Soil Descriptions

AfB—Alford silt loam, 1 to 8 percent slopes. This deep, gently sloping, well drained soil is mainly on broad ridgetops in the uplands, but it also is in benchlike areas and in a few upland coves. Most areas have short, uniform, smooth or convex slopes. They range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is yellowish brown and brown, friable and firm silt loam about 47 inches thick. The substratum to a depth of about 80 inches is yellowish brown, very friable silt loam. In a few places the subsoil has gray mottles below a depth of about 3 feet.

Included with this soil in mapping are narrow strips of the Westmoreland soils near slope breaks. These soils have coarse fragments and contain more sand in the subsoil than the Alford soil. Also included are small areas of Cincinnati soils near the edge of some ridgetops. These soils have a fragipan. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Alford soil. Available water capacity is high. Runoff is medium in cultivated areas. The shrink-swell potential is moderate in the subsoil, and the potential for frost action is high. Unless the soil is limed, the subsoil is medium acid to very strongly acid.

Most areas are used as cropland. This soil is well suited to corn, soybeans, small grain, grasses and legumes for hay, and many specialty crops. Because of the high potential for frost action, stands of deep-rooted legumes, such as alfalfa, are difficult to maintain in many areas. The soil can be tilled early in spring. Cultivated crops can be grown year after year if erosion is controlled. The erosion hazard is moderate if the soil is cultivated or if the protective plant cover is removed. A system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, cover crops, and contour tillage reduce the hazard of erosion. A few long slopes are suited to contour stripcropping. The surface layer crusts after hard rains. Tilling within the proper range of moisture content helps to prevent excessive crusting and compaction. The soil is suited to sprinkler irrigation if erosion is controlled.

Some areas are pastured. This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a very small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

Some areas are used as building sites. This soil is well suited to buildings and septic tank absorption fields. Properly designing foundations and footings and backfilling along the foundations with material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material. Maintaining as much vegetation on the site as possible during construction helps to control runoff and erosion.

The land capability classification is IIe. The woodland ordination symbol is 1a.

AfC—Alford silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is dominantly on smooth, rounded ridgetops, in coves, and in benchlike areas. Some areas have dissected, uneven slopes. Most are oblong or irregularly shaped. They range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is yellowish brown and brown, friable and firm silt loam about 47 inches thick. The substratum to a depth of about 80 inches is yellowish brown, very friable silt loam. In a few places the subsoil has gray mottles below a depth of about 3.5 feet. Some areas are eroded. In a few areas stone fragments are in the lower part of the soil.

Included with this soil in mapping are narrow strips of Westmoreland soils near slope breaks. These soils have a higher content of sand and coarse fragments in the subsoil than the Alford soil. Also included are small areas of Cincinnati soils near the center of ridgetops. These soils have a fragipan. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Alford soil. Available water capacity is high. Unless the soil is limed, the subsoil is very strongly acid to medium acid. Runoff is rapid in cultivated areas. The shrink-swell potential is moderate in the subsoil, and the potential for frost action is high.

Most areas are used as cropland or pasture. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Because of the high potential for frost action, maintaining a stand of deep-rooted legumes is difficult. The soil can be tilled early in the spring. Because of poor air drainage, crops in some of the low lying areas can be damaged by frost. Smooth, even slopes are better suited to cultivated crops than dissected, uneven slopes.

If this soil is cultivated or the protective plant cover is removed, the erosion hazard is severe. Controlling erosion and maintaining tilth and the organic matter content are management concerns. If conservation measures are applied, a common rotation includes a cultivated crop or small grain every other year. A system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, contour stripcropping, cover crops, grassed waterways, and a mulch of crop residue reduce the hazard of erosion. In some areas diversions intercept runoff from adjacent slopes. The surface layer crusts after hard rains. Tilling within the proper range of moisture content helps to prevent excessive crusting and compaction.

This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

This soil is moderately well suited to buildings and septic tank absorption fields. The slope and the moderate shrink-swell potential are the main limitations. Designing buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent excessive seepage of effluent to the surface. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

Low strength and frost action are limitations on sites for local roads and streets. Providing suitable base material minimizes the damage caused by these limitations.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

AfD—Alford silt loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on benches on the lower parts of slopes and in coves at the head of drainageways. Slope is dominantly 15 to 20 percent. Most areas are oblong or irregularly shaped. They range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown and brown, friable and firm silt loam about 45 inches thick. The substratum to a depth of about 80 inches is yellowish brown, very friable silt loam. In a few places the subsoil has gray mottles below a depth of about 3.5 feet. Some areas are eroded. In a few areas the soil has stone fragments in the surface layer and a higher content of coarse fragments in the lower part.

Included with this soil in mapping are narrow strips of Westmoreland soils on slope breaks. These soils make up about 10 percent of most areas.

Permeability is moderate in the Alford soil. Available water capacity is high. Runoff is very rapid. The shrink-swell potential is moderate in the subsoil. The potential for frost action is high. Unless the soil is limed, the subsoil is very strongly acid to medium acid.

Only a small acreage is used for crops. This soil is poorly suited to cropland. It is better suited to hay, pasture, and small grain than to cultivated crops. Row crops can be grown occasionally in rotation with grasses and legumes if erosion is controlled and good management is applied. A commonly used rotation includes cultivated crops once every 4 years. The small, irregularly shaped tracts in areas dissected by drainageways are very poorly suited to cultivated crops.

If this soil is cultivated or the protective plant cover is removed, the erosion hazard is very severe. Controlling erosion and maintaining tilth and the organic matter content are management concerns. Contour stripcropping, a system of conservation tillage that leaves crop residue on the surface, diversions, and grassed waterways reduce the hazards of runoff and erosion in cultivated areas. Planting winter cover crops, mulching with manure, leaving crop residue on the surface during winter, including grasses and legumes in the cropping sequence, and incorporating crop residue into the plow layer help to control erosion and maintain tilth.

Most areas are pastured. This soil is moderately well suited to pasture. Maintaining stands of deep-rooted legumes, such as alfalfa, is difficult in many areas because of the high potential for frost action. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Many areas are used as woodland. This soil is well suited to trees and to habitat for woodland wildlife. Mowing, spraying, and disking help to control plant competition. Laying out skid trails and logging roads on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also help to control erosion. North- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and have more moisture available for plant growth because they are less exposed to the prevailing wind and the sun.

This soil is poorly suited to buildings and septic tank absorption fields because of the slope. Designing buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Drainageways should not be selected as building sites. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Maintaining a plant cover during construction and reseeding or mulching reduce the hazard of erosion. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent excessive seepage of effluent to the surface.

Low strength, frost action, and slope are limitations on sites for local roads and streets. The damage caused by low strength and frost action can be minimized by providing suitable base material. The roads and streets should be built on the contour. Trails in recreation areas should be protected against erosion and laid out on the contour wherever possible.

The land capability classification is IVe. The woodland ordination symbol is 1r.

AmB2—Amanda silt loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, well drained soil is on end moraines and ground moraines in the uplands. It is in smooth and convex areas on ridges and knolls. Most areas are elongated. They range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. Erosion has removed part of the original surface soil. The remaining surface layer is a mixture of the original surface layer and subsoil material. The subsoil is dark yellowish brown and brown, firm clay loam about 37 inches thick. The substratum to a depth of about 80 inches is brown, firm loam. In a few places the upper part of the subsoil has more silt and less sand and a higher content of coarse fragments.

Included with this soil in mapping are small areas of the somewhat poorly drained Bennington soils along small drainageways. These soils make up about 5 percent of most areas.

Available water capacity is moderate or high in the Amanda soil. The shrink-swell potential in the subsoil and the potential for frost action are moderate. Permeability is moderately slow. Runoff is medium in cultivated areas. Unless the soil is limed, the subsoil is very strongly acid to medium acid in the upper part and medium acid to mildly alkaline in the lower part. A seasonal high water table is below a depth of 48 inches.

Most of the acreage is cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. If the soil is cultivated, the hazard of erosion is moderate. Cultivated crops, such as corn and soybeans, can be grown year after year, however, if erosion is controlled. Controlling erosion and maintaining tilth and the organic matter content are management concerns. The surface layer crusts after hard rains. Applying a system of conservation tillage that leaves crop residue on the surface, farming on the contour, stripcropping, growing cover crops, incorporating crop residue into the plow layer, and including grasses and legumes in the cropping sequence help to control erosion and maintain tilth. Tilling within the proper range of moisture content helps to prevent excessive compaction and crusting.

A small acreage is pastured. This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to keep the pasture in good condition. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is wooded. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition. Removing vines and the less desirable trees and shrubs also helps to control plant competition.

This soil is well suited to buildings. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the 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.

This soil is only moderately well suited to septic tank absorption fields because of the moderately slow permeability. This limitation generally can be overcome by alternating the distribution of effluent into two absorption fields. Widening the bottom of the trench in the absorption fields also helps to overcome this limitation.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIe. The woodland ordination symbol is 1a.

AmC2—Amanda silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on side slopes and knolls in the uplands. Slopes are commonly smooth. Most areas are oblong and range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. Erosion has removed part of the original surface layer. The remaining surface layer is a mixture of the original surface layer and subsoil material. The subsoil is dark yellowish brown and brown, firm clay loam about 37 inches thick. The substratum to a depth of about 80 inches is brown, firm loam.

Included with this soil in mapping are spots of severely eroded soils. These soils have a subsoil that is thinner than that of the Amanda soil. Also, they have a lower available water capacity and are less productive. They make up 10 percent of most areas.

Permeability is moderately slow in the Amanda soil. Available water capacity is moderate or high. The potential for frost action is moderate. The shrink-swell potential is moderate in the subsoil. Runoff is rapid in cultivated areas. Unless the soil is limed, the subsoil is very strongly acid to medium acid in the upper part and medium acid to mildly alkaline in the lower part. A seasonal high water table is below a depth of 48 inches.

Most areas are used as cropland. This soil is moderately well suited to corn, soybeans, and small grain. Smooth, even slopes are better suited to cultivated crops than dissected, uneven slopes. Erosion is a severe hazard in cultivated areas, especially if the soil is plowed in the fall. Controlling erosion and maintaining tilth and the organic matter content are the main management concerns. The surface layer crusts after hard rains. Including grasses and legumes in the cropping sequence reduces the hazard of erosion. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, cover crops, and grassed waterways also reduce this hazard. Tilling within the proper range of moisture content helps to prevent excessive compaction and crusting. In some areas diversions are needed to intercept runoff from the higher adjacent soils.

Only a small acreage is pastured. This soil is well suited to grasses and legumes for hay and pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is wooded. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition. Removing vines and the less desirable trees and shrubs also helps to control plant competition.

This soil is moderately well suited to buildings. The buildings should be designed so that they conform to the natural slope of the land. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the 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. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

Because of the moderately slow permeability and the slope, this soil is poorly suited to septic tank absorption fields. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface. The moderately slow permeability can be overcome by alternating the distribution of effluent into two absorption fields. Widening the bottom of the trench in the absorption fields also helps to overcome this limitation.

Low strength, frost action, and slope are limitations on sites for local roads and streets. The damage caused by low strength and frost action can be minimized by providing suitable base material and by installing a drainage system. The roads and streets should be built on the contour.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

AmD2—Amanda silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, well drained soil is on knolls, on side slopes, and along drainageways in the uplands. Most areas are long and narrow. They range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. Erosion has removed part of the original surface layer. The remaining surface layer is a mixture of the original surface layer and subsoil material. The subsoil is yellowish brown and brown, firm clay loam about 37 inches thick. The substratum to a depth of about 80 inches is brown, firm loam.

Included with this soil in mapping are spots of severely eroded soils. These soils have a lower available water capacity than the Amanda soil and are less productive. Also included are narrow strips of Amanda soils that have a slope of 20 to 30 percent. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in the Amanda soil. Available water capacity is moderate or high. The shrink-swell potential in the subsoil and the potential for frost action are moderate. Runoff is very rapid in cultivated areas. Unless the soil is limed, the subsoil is very strongly acid to medium acid in the upper part and medium acid to mildly alkaline in the lower part. A seasonal high water table is below a depth of 48 inches.

A few areas are used as cropland. This soil is poorly suited to cultivated crops. It is moderately well suited to most grasses and legumes for hay and to occasionally grown small grain. A commonly used rotation includes a cultivated crop once every 4 years. In cultivated areas the hazard of erosion is very severe. Controlling erosion and maintaining the organic matter content are management concerns. No-till or other systems of conservation tillage that leave crop residue on the surface, incorporation of crop residue into the plow layer, a cropping sequence that includes grasses and legumes, contour stripcropping, cover crops, diversions, and grassed waterways reduce the hazard of erosion.

Most areas are pastured. This soil is moderately well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to keep the pasture in good condition. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is used as woodland. This soil is well suited to trees. The slope somewhat limits the use of equipment. Mowing, spraying, and disking help to control plant competition. Removing vines and the less desirable trees and shrubs also helps to control plant competition. Laying out skid trails and logging roads on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also reduce the hazard of erosion.

This soil is poorly suited to buildings and septic tank absorption fields because of the slope and the moderately slow permeability. Land shaping is needed on building sites. If retaining walls are used, the buildings can be designed so that they conform to the natural slope of the land. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the 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 the distribution lines in septic tank absorption fields across the slope helps to prevent excessive seepage of effluent to the surface. The moderately slow permeability can be overcome by alternating the distribution of effluent into two absorption fields.

The slope is the main limitation on sites for local roads and streets. It can be overcome by constructing across the slope. The damage caused by low strength and frost action can be minimized by providing suitable base material and by installing a drainage system. The erosion hazard during construction is very severe. It can be reduced by reseeding or mulching bare slopes and by keeping excess water from collecting and flowing on unpaved streets and driveways.

The land capability classification is IVe. The woodland ordination symbol is 1r.

BeA—Bennington silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on flats, in small depressions, and along small drainageways in the uplands. Most areas are oval or elongated. They range from 3 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is grayish brown, mottled, friable silt loam about 3 inches thick. The subsoil is about 31 inches thick. It is yellowish brown, mottled, and firm. The upper part is silty clay loam, and the lower part is clay loam. The substratum to a depth of about 80 inches is brown, calcareous, firm loam. It is mottled within a depth of 52 inches.

Included with this soil in mapping are small areas of the moderately well drained Centerburg soils on low rises. Also included are small areas of the poorly drained and very poorly drained Pewamo soils in the lower landscape positions. These soils are darker than the Bennington soil. Included soils make up 10 to 20 percent of most areas.

Permeability is slow in the Bennington soil. A seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Surface runoff is slow. The root zone is restricted by the water table and the depth to compact glacial till. It is deep or moderately deep in adequately drained areas. Available water capacity is moderate or high. The shrink-swell potential is moderate in the subsoil, and the potential for frost action is high. Unless the soil is limed, the subsoil is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part.

Most areas are drained and are used as cropland. In drained areas this soil is well suited to intensively grown corn, soybeans, small grain, and hay. Yields are reduced in wet periods. Subsurface drains help to lower the seasonal high water table (fig. 2). Diversions at the base of the adjacent slopes intercept runoff from the higher lying soils. The surface layer crusts after hard rains. Applying a system of conservation tillage and incorporating crop residue into the plow layer help to maintain tilth and the organic matter content. The soil is suited to no-till planting if it is drained, but planting is generally delayed by wetness. Tilling within the proper range of moisture content helps to prevent excessive surface compaction and crusting.

A few areas are pastured. This soil is well suited to pasture. It is suited to Kentucky bluegrass, tall fescue, ladino clover, alsike clover, birdsfoot trefoil, and reed canarygrass. Maintaining stands of deep-rooted legumes is difficult, particularly in undrained areas. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of fertilizer help to keep the pasture in good condition. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the seasonal wetness, this soil is poorly suited to buildings. Wet basements and muddy lots can be expected. Subsurface drains and open ditches reduce the wetness. In places diversions that intercept runoff from the higher adjacent slopes also reduce the wetness. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Agricultural drainage outlets generally are not large enough or deep enough to carry all of the excess water from residential areas. Building sites should be landscaped so that surface water flows away from the foundations.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. Installing perimeter drains around the absorption fields lowers the seasonal high water table. The slow permeability can be overcome by widening the bottom of the trench in the absorption fields. Excavation is limited during winter and spring because of the wetness. The wetter included soils should not be selected as sites for buildings or septic tank absorption fields.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by installing a drainage system and by providing suitable base material.

The land capability classification is IIw. The woodland ordination symbol is 2a.

BhB—Bethesda silt loam, 0 to 8 percent slopes. This deep, nearly level and gently sloping, well drained soil is on narrow and broad ridges of mine spoil in areas that formerly were surface mined for coal. These areas

Figure 2.—Installation of subsurface drains in an area of Bennington silt loam, 0 to 3 percent slopes.

have been reclaimed. The surface has been graded and blanketed with a layer of material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. Slopes are smooth and convex. Most areas are 3 to 20 acres in size.

Typically, the surface layer is mixed brown and yellowish brown, friable silt loam about 9 inches thick. The upper part of the substratum is dark gray, firm very shaly silty clay loam. The lower part to a depth of about 80 inches is variegated yellowish brown and gray, firm very channery clay loam. Some areas have been blanketed with 10 to 20 inches of natural soil material.

Included with this soil in mapping are unreclaimed areas where the surface layer is channery silt loam and a few severely eroded areas where rills and small gullies have formed. The thin, flat stones in the channery areas interfere with tillage. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Bethesda soil. Runoff is slow or medium. Available water capacity is low. The potential for frost action is moderate. Unless the soil is limed, the substratum is extremely acid to strongly acid. The root zone generally is moderately deep, but the depth can vary within short distances because of large buried stones or differences in the density of the material.

Only a small acreage is used for row crops. This soil is poorly suited to cropland. It is better suited to small grain and hay than to corn because it is droughty. In many areas deep-rooted legumes, such as alfalfa, are difficult to maintain because of the acidity and other limiting characteristics of the substratum. In cultivated areas the hazard of erosion is moderate. The soil is suited to no-till planting and to shallow tillage. Controlling erosion, conserving moisture, improving tilth, and increasing the organic matter content are management concerns. A cropping system that includes grasses and legumes, cover crops, contour stripcropping, and a system of conservation tillage that leaves crop residue on the surface reduce the hazard of erosion, improve tilth, and increase the organic matter content.

Most of the acreage is pastured or is idle grassland. This soil is moderately well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

This soil is moderately well suited to trees and to habitat for openland and woodland wildlife. Because of recent mining, however, no areas are used as woodland. Grasses and legumes help to provide ground cover during the establishment of trees. Spraying and mowing help to control plant competition.

Onsite investigation is needed to determine the suitability of this soil for buildings. Once it has settled, the soil is moderately well suited to this use. The thickness of the soil over bedrock and the need to control storm water runoff should be considered during the site investigation. The soil material in the deeper areas usually requires a longer period to settle. In a few areas that were used as woodland prior to mining, trees and woody debris are buried. These areas should not be used as building sites because of the hazard of subsidence. The stones in the substratum hinder excavation. Droughtiness adversely affects lawns during dry periods.

Because of the moderately slow permeability and unstable fill, this soil is poorly suited to septic tank absorption fields. The moderately slow permeability can be overcome by installing the absorption field in suitable fill material or by alternating the distribution of effluent into two absorption fields.

This soil has a highly corrosive effect on concrete and a moderately corrosive effect on uncoated steel. Coated steel or heavy-duty PVC pipe should be used in drainage and sewer lines. High-quality polyethylene pipe should be used in water lines.

The unstable fill is a limitation on sites for local roads and streets. Onsite investigation is needed to determine the suitability of the soil for this use.

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

BhD—Bethesda silt loam, 8 to 20 percent slopes. This deep, strongly sloping and moderately steep, well drained soil is on narrow mine-spoil ridges, knolls, and side slopes in areas that formerly were surface mined for coal. These areas have been reclaimed. The surface has been graded and blanketed with a layer of material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. Slopes are smooth and are dominantly 8 to 15 percent. They are irregular along a few drainageways. Areas range from about 3 to 20 acres in size.

Typically, the surface layer is mixed brown and yellowish brown, friable silt loam about 9 inches thick. The upper part of the substratum is dark gray, firm very shaly silty clay loam. The lower part to a depth of about 80 inches is variegated yellowish brown and gray, firm very channery clay loam.

Included with this soil in mapping are unreclaimed areas where the surface layer is channery silt loam and a few severely eroded areas where rills and small gullies have formed. The thin, flat stones in the channery areas interfere with tillage. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Bethesda soil. Runoff is rapid or very rapid. Available water capacity is low. The potential for frost action is moderate. Unless the soil is limed, the substratum is extremely acid to strongly acid. The root zone generally is moderately deep, but the depth can vary within short distances because of large buried stones or differences in the density of the material.

Most of the acreage is used for hay and pasture. A few areas are used for row crops. This soil is poorly suited to cropland. It is better suited to small grain and hay than to corn because it is droughty. Corn should be grown under no-till management. Stands of deep-rooted legumes, such as alfalfa, are difficult to maintain in most areas because of the acidity and other limiting characteristics of the substratum. If the soil is cultivated, the hazard of erosion is severe or very severe. Controlling erosion, conserving moisture, improving tilth, and increasing the organic matter content are management concerns. Including grasses and legumes in the cropping system and planting cover crops reduce the hazard of erosion, improve tilth, and increase the organic matter content.

This soil is poorly suited to pasture. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

This soil is moderately well suited to trees and to habitat for openland and woodland wildlife. Because of recent mining, however, no areas are used as woodland. Grasses and legumes help to provide ground cover during the establishment of trees. Spraying and mowing help to control plant competition.

Onsite investigation is needed to determine the suitability of this soil for buildings. Once it has settled, the soil is moderately well suited or poorly suited to this use. The thickness of the soil over bedrock and the need to control storm water runoff should be considered during the site investigation. Designing buildings so that they conform to the natural slope of the land minimizes cutting, filling, land shaping, and the possibility of slippage. The higher and more convex parts of slopes are generally the best sites for buildings. Reseeding or mulching during construction helps to control erosion. Droughtiness adversely affects lawns. The stones in the substratum hinder excavation.

Because of the moderately slow permeability and unstable fill, this soil is poorly suited to septic tank absorption fields. The moderately slow permeability can be overcome by installing the absorption field in suitable fill material or by alternating the distribution of effluent into two absorption fields. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

This soil has a highly corrosive effect on concrete and a moderately corrosive effect on uncoated steel. Coated steel or heavy-duty PVC pipe should be used in drainage and sewer lines. High-quality polyethylene pipe should be used in water lines.

The unstable fill is a limitation on sites for driveways and for local roads and streets. Onsite investigation is needed to determine the suitability of the soil for these uses.

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

BkB—Bethesda channery loam, 0 to 8 percent slopes. This deep, nearly level and gently sloping, well drained soil is in areas that formerly were surface mined for coal. It is on mine-spoil ridges and to a lesser extent in basins between spoil ridges and backfill benches. Ridge crests commonly are rounded but have irregular slopes. Rills and small gullies have formed along the edge of some ridges. Most basins are drained by a small waterway, but some do not have drainage outlets and periodically contain water. Most areas are 3 to 15 acres in size.

This soil is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. Rock fragments are mostly flat and are 1 to 5 inches long. They are mainly shale, siltstone, fine grained sandstone, and smaller amounts of coal and carbonaceous roof shale. A few stones are on the surface and throughout the soil.

Typically, the surface layer is dark grayish brown, friable channery loam about 5 inches thick. The substratum to a depth of about 80 inches is variegated yellowish brown and gray, friable very channery clay loam and very channery loam.

Included with this soil in mapping are small areas of Enoch soils. These soils are ultra acid throughout and are bare of vegetation. In places the surface layer of these soils appears moist because of a high concentration of salts. These soils make up about 15 percent of most areas.

Permeability is moderately slow in the Bethesda soil. Runoff is slow or medium. Available water capacity is low. The potential for frost action is moderate. The organic matter content is very low. The depth of the root zone can vary within short distances because of differences in the density of the material and because of a few large stones. Unless the soil is limed, the substratum is strongly acid to extremely acid.

Because the rock fragments in the surface layer interfere with tillage, this soil is generally unsuited to hay and to the commonly grown field crops. It is droughty, low in fertility, and very low in organic matter content. The surface layer has weak structure. It puddles and crusts easily. Erosion is a moderate hazard in unvegetated areas.

A few areas are pastured. This soil is poorly suited to pasture. Areas where lime and fertilizer have not been applied generally support thin stands of grasses interspersed with bare spots. Much of the rainfall runs off the surface because of the poor soil structure and the sparse plant cover. The soil is generally low in content of nitrogen and phosphorus and is medium in content of potassium. Fertilizer should be applied according to the results of soil tests. A plant cover and surface mulch reduce the runoff rate and the susceptibility to erosion and increase the rate of water intake. Proper stocking rates and rotation grazing are needed. Overgrazing depletes the stand of plants and increases the runoff rate and the susceptibility to erosion. Orchardgrass, tall fescue, and Korean lespedeza are some of the forage plants that grow best on this soil. A water supply for livestock is commonly not available, but many areas have potential reservoir sites. Large stones in some areas interfere with mowing and reseeding.

Most areas are used as woodland, mainly 10- to 40-year-old stands of aspen, sycamore, silver maple, red maple, and black locust. This soil is suited to trees that can withstand the strongly acid to extremely acid conditions and the droughtiness. Grasses help to provide ground cover during the establishment of trees. Mechanical planting is not practical because of the rock fragments in the surface layer. Mowing helps to control plant competition.

This soil could be used for specialty crops, such as blueberries. Many areas have potential sites for reservoirs, which can provide water for irrigation.

Onsite investigation is needed to determine the suitability of this soil for buildings. Once it has settled, the soil is moderately well suited to this use. Areas that have buried trees or other organic material beneath the surface are unsuitable as sites for buildings. The thickness of the soil over bedrock and the need to control storm water runoff should be considered during the site investigation. Stones hinder excavation. Sites for lawns should be blanketed with suitable soil material, which provides a more favorable root zone, increases the available water capacity, and covers small stones that can interfere with mowing.

Because of the moderately slow permeability and unstable fill, this soil is poorly suited to septic tank absorption fields. The moderately slow permeability can be overcome by installing the absorption field in suitable fill material or by alternating the distribution of effluent into two absorption fields.

This soil has a highly corrosive effect on concrete and a moderately corrosive effect on uncoated steel. Coated steel or heavy-duty PVC pipe should be used in drainage and sewer lines. High-quality polyethylene pipe should be used in water lines.

The unstable fill is a limitation on sites for local roads and streets. Onsite investigation is needed to determine the suitability of the soil for this use.

The capability classification is VIs. No woodland ordination symbol is assigned.

BkD—Bethesda channery loam, 8 to 20 percent slopes. This deep, strongly sloping and moderately steep, well drained soil is in areas that formerly were surface mined for coal. It is on mine-spoil side slopes and to a lesser extent on mine-spoil benches and narrow ridgetops. It is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. The rock fragments are mostly flat and are 1 to 5 inches long. They are mainly shale, fine grained sandstone, siltstone, and smaller amounts of coal and carbonaceous roof shale. In most areas a few large stones are on and beneath the surface. Slope is dominantly 8 to 15 percent. Most areas have irregular slopes. They range from 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown, friable channery loam about 4 inches thick. The substratum to a depth of about 80 inches is variegated yellowish brown and gray, friable very channery clay loam and very channery loam.

Included with this soil in mapping are small areas of Enoch soils. These soils are ultra acid throughout and are bare of vegetation. In places the surface layer of these soils appears moist because of soluble salts on the surface. Also included are a few extremely stony areas and narrow, very steep escarpments. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Bethesda soil. Runoff is very rapid in unprotected areas. The depth of the root zone can vary within short distances because of differences in the density of the material and because of a few large stones. Available water capacity is low because of the high content of coarse fragments and the compactness in the root zone. The organic matter content is very low. The potential for frost action is moderate. Unless the soil is limed, the substratum is strongly acid to extremely acid.

A small acreage is pastured. This soil generally is unsuited to the commonly grown field crops and to hay. It is poorly suited to pasture because it is a poor medium for root development. The soil is droughty, low in fertility, and very low in organic matter content. The surface layer is channery, has weak structure, and puddles and crusts easily. Much of the rainfall runs off the surface because of the poor structure and a sparse plant cover. Erosion is a very severe hazard in unprotected areas. Rock fragments in the surface layer interfere with tillage. A few large stones interfere with pasture management. Areas where lime and fertilizer have not been applied generally support only thin stands of grasses interspersed with bare spots. The soil is generally low in nitrogen and phosphorus and medium in potassium. Soil tests are needed to determine specific nutrient needs. Ground cover and surface mulch reduce the runoff rate and the hazard of erosion and increase the rate of water intake.

Orchardgrass, tall fescue, and Korean lespedeza are some of the forage plants that grow best on this soil. Proper stocking rates and rotation grazing help to maintain the stands. Overgrazing results in deterioration of the stand and increases the runoff rate and the hazard of erosion. Water for livestock is not available in many areas, but potential reservoir sites are available.

This soil could be used for specialty crops, such as blueberries. Many areas have potential sites for reservoirs, which can provide water for irrigation. The slope and a slow water intake rate are limitations in irrigated areas.

Most areas are used as woodland, mainly somewhat young stands of aspen, sycamore, silver maple, red maple, and black locust. This soil is suited to trees that can withstand the droughtiness. Grasses help to provide ground cover during the establishment of trees. Mechanical planting is not practical because of the rock fragments in the surface layer. Mowing helps to control plant competition.

Onsite investigation is needed to determine the suitability of this soil for buildings. Once the soil has settled, convex areas where slopes are 8 to 15 percent are moderately well suited or poorly suited to buildings. Drainageways and concave areas should not be selected as buildings sites. Areas that have buried trees or other organic material beneath the surface also are unsuitable as building sites. Areas on spoil outslopes where the slope is more than 15 percent generally are unsuited to buildings and septic tank absorption fields. The thickness of the soil over bedrock, the susceptibility to hillside slippage, and the need to control storm water runoff are management concerns. Designing buildings so that they conform to the natural slope of the land minimizes cutting, filling, land shaping, and the possibility of hillside slippage. Reseeding or mulching during construction helps to control erosion. Stones hinder excavation.

Because of the restricted root zone, droughtiness adversely affects lawns. Rock fragments interfere with mowing. Sites for lawns should be blanketed with suitable soil material, which provides a more favorable root zone, increases the available water capacity, and covers small stones that can interfere with mowing.

Because of the moderately slow permeability and unstable fill, this soil is poorly suited to septic tank absorption fields. The moderately slow permeability can be overcome by installing the absorption field in suitable fill material or by alternating the distribution of effluent into two absorption fields. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

This soil has a highly corrosive effect on concrete and a moderately corrosive effect on uncoated steel. Coated steel or heavy-duty PVC pipe should be used in drainage and sewer lines. High-quality polyethylene pipe should be used in water lines.

The unstable fill is a limitation on sites for driveways and for local roads and streets. Onsite investigation is needed to determine the suitability of the soil for these uses. Designing the driveways, roads, and streets so that water does not collect and flow in unpaved areas helps to control erosion.

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

BkF—Bethesda channery loam, 40 to 70 percent slopes. This very steep, deep, well drained soil is on mine-spoil side slopes and very narrow ridges in areas that formerly were surface mined for coal. It is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. The rock fragments are mostly flat or blocky and range from 1 to 6 inches in size. Most areas have not been graded and smoothed. Slopes generally are rough and uneven and occur as cone-shaped piles or as a series of narrow ridges. Some spoil outslopes are susceptible to slippage. Most areas have bedrock highwalls and contain long, narrow pools of water adjacent to the highwall. Areas generally are 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable channery loam about 3 inches thick. The substratum to a depth of about 80 inches is variegated yellowish brown and gray, friable very channery clay loam and very channery loam.

Included with this soil in mapping are small areas of Enoch soils. These soils are ultra acid throughout and are bare of vegetation. They appear moist in a few areas because of soluble salts. Also included are small areas of very stony or extremely stony soils and small areas that have a slope of 20 to 40 percent. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Bethesda soil. Runoff is very rapid. The depth of the root zone can vary within short distances because of large stones and differences in the density of the material. Available water capacity is low in the root zone. The potential for frost action is moderate. Unless the soil is limed, the substratum is strongly acid to extremely acid.

This soil generally is unsuited to cropland and pasture because of the very steep, uneven slopes, the small stones in the surface layer, droughtiness, and a very severe hazard of erosion.

Most of the acreage is wooded, mainly with low-quality trees. This soil is suited to selected trees. Grasses help to provide ground cover during the establishment of trees in sparsely vegetated areas. Mechanical planting is not possible because of the very steep slopes and the rock fragments in the surface layer.

This soil generally is unsuited to buildings and septic tank absorption fields because of the very steep slopes, unstable fill, and moderately slow permeability. Areas where water impoundments are available have potential for some recreational uses.

The land capability subclass is VIIe. No woodland ordination symbol is assigned.

BvF—Brownsville silt loam, 40 to 70 percent slopes. This deep, well drained, very steep soil is on hillsides. It commonly occurs as long, narrow strips below the wider ridgetops. Slopes generally are smooth but are slightly concave in the lower landscape positions. Most areas range from 10 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 5 inches thick. The subsoil is yellowish brown, friable channery and very channery silt loam about 26 inches thick. The substratum is yellowish brown, friable extremely channery loam. Fractured siltstone bedrock is at a depth of about 50 inches. In some areas the soil is moderately deep to bedrock.

Included with this soil in mapping are small areas of Gilpin soils on narrow ridgetops. These soils have fewer coarse fragments in the subsoil than the Brownsville soil. Also included are small areas of soils that are shallow to bedrock. These soils are on slope breaks near the upper part of the hillsides and in convex areas on the end of ridges. Included soils make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil. Available water capacity is low. The soil is droughty. The root zone is deep over fractured siltstone bedrock. Runoff is very rapid. Unless the soil is limed, the subsoil is strongly acid to extremely acid.

This soil generally is unsuited to cropland and pasture because of the very steep slope, a very severe hazard of erosion, and the droughtiness.

Nearly all of the acreage is used as woodland and as habitat for woodland wildlife. This soil is moderately well suited to trees and to habitat for woodland wildlife. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also help to control erosion. Planting seedlings that have been transplanted once reduces the seedling mortality rate. North- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and have more moisture available for plant growth because they are less exposed to the prevailing wind and the sun.

The soil generally is unsuited to buildings and septic tank absorption fields because of the very steep slope. Some areas are scenic lookout points and have potential for some recreational uses. Laying out trails in recreation areas on the contour reduces the hazard of erosion.

The land capability classification is VIIe. The woodland ordination symbol is 3r on north aspects, 4r on south aspects.

CdB—Centerburg silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on ridgetops and side slopes. Most areas have smooth slopes. They range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is dark yellowish brown, mottled, firm clay loam and loam about 28 inches thick. The substratum to a depth of about 80 inches is dark yellowish brown, mottled, firm, calcareous loam. In places the soil has a silty mantle 18 to 24 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Bennington soils along small drainageways and in slight depressions. These soils make up about 15 percent of most areas.

Permeability is moderately slow in the Centerburg soil. Runoff is medium. Available water capacity is moderate or high. A seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. The shrink-swell potential is moderate in the subsoil. The potential for frost action is high. The subsoil is strongly acid to neutral.

Most of the acreage is farmed. This soil is well suited to corn, soybeans, and small grain and to most grasses and legumes for hay. Deep-rooted legumes are subject to frost heaving. Erosion and surface crusting are management concerns. A cropping sequence that includes grasses and legumes, grassed waterways, contour tillage, contour stripcropping on the longer slopes, conservation tillage, incorporation of crop residue into the plow layer, cover crops, and tillage within the proper range of moisture content increase the rate of water infiltration and help to prevent excessive crusting and erosion. Subsurface drains are needed in the wetter included soils.

This soil is well suited to pasture, but only a small acreage is pastured. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is wooded. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition. Removing vines and the less desirable trees and shrubs also helps to control plant competition.

Because of the seasonal wetness and the moderate shrink-swell potential in the subsoil, this soil is only moderately well suited to buildings. The higher or more convex parts of slopes are the best sites for buildings. 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 helps to prevent the damage caused by shrinking and swelling. Maintaining as much vegetation on the site as possible during construction and reseeding or mulching help to control erosion.

This soil is moderately well suited to septic tank absorption fields. The seasonal wetness and the moderately slow permeability are severe limitations. The wetter included soils should not be selected as sites for absorption fields. Installing perimeter drains around the absorption fields lowers the seasonal high water table. The moderately slow permeability can be overcome by alternating the distribution of effluent into two absorption fields. Widening the bottom of the trench in the absorption fields also helps to overcome this limitation.

Frost action is a limitation on sites for local roads and streets. The damage caused by this limitation can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIe. The woodland ordination symbol is 1a.

CkB—Cincinnati silt loam, 1 to 8 percent slopes. This deep, gently sloping, well drained soil is on wide, slightly rounded ridgetops. Slopes are dominantly smooth to convex. Most areas are oblong or irregularly shaped. They range from 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 70 inches thick. The upper part is strong brown, friable silt loam and firm silty clay loam; the next part is a fragipan of strong brown, mottled, very firm and brittle silty clay loam; and the lower part is strong brown, mottled, firm clay loam. In some areas the soil is clayey below the fragipan.

Included with this soil in mapping are small areas of Alford and Guernsey soils. These soils do not have a fragipan. Alford soils are mainly in the center of the ridgetops. Guernsey soils are on low rises or near seepy spots. Included soils make up 5 to 15 percent of most areas.

Permeability is moderate above the fragipan in the Cincinnati soil and moderately slow or slow in and below the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during wet periods. Available water capacity is moderate. Runoff is medium in cultivated areas. The shrink-swell potential is moderate in the fragipan and in the lower part of the subsoil. The potential for frost action is high. Unless the soil is limed, the part of the subsoil above the fragipan is very strongly acid or strongly acid.

Most areas are used as cropland or pasture. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Deep-rooted legumes, such as alfalfa, however, are damaged by frost heaving in many areas. The soil dries slowly in spring. The erosion hazard is moderate in cultivated areas, but cultivated crops can be grown year after year if erosion is controlled. The surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface, incorporation of crop residue into the plow layer, a cropping sequence that includes grasses and legumes, grassed waterways, cover crops, and contour tillage or stripcropping reduce the hazard of erosion, improve tilth, and help to prevent excessive crusting. Tilling within the proper range of moisture content helps to prevent excessive compaction. The soil is suited to irrigation if erosion is controlled.

The wetness of the included Guernsey soils delays planting in some years. Diversions or subsurface drains at the base of slopes reduce the wetness. Randomly spaced subsurface drains remove excess water from seepy areas near the included Guernsey soils. A complete subsurface drainage system is practical only in some areas that are used for high-value crops.

This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

Because of the seasonal wetness, this soil is only moderately well suited to buildings. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the moderately slow or slow permeability. The restricted permeability can be overcome by installing the absorption field in suitable fill material, by installing the distribution lines as shallow as possible, and by alternating the distribution of effluent into two absorption fields. Installing perimeter drains around the absorption fields reduces the seasonal wetness.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIe. The woodland ordination symbol is 2a.

CkC2—Cincinnati silt loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is dominantly on ridgetops and the adjacent side slopes. Except for dissected areas along a few small drainageways, most areas have smooth slopes. They range from 5 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. Erosion has removed part of the original surface layer. The remaining surface layer is a mixture of the original surface layer and subsoil material. The subsoil is about 72 inches thick. The upper part is strong brown, friable silt loam and firm silt clay loam; the next part is a fragipan of strong brown, very firm and brittle silty clay loam; and the lower part is strong brown, mottled, firm clay loam. In places, the soil does not have a fragipan and the lower part of the soil is clayey or loamy material weathered from the underlying bedrock.

Included with this soil in mapping are small areas of Homewood and Guernsey soils. Homewood soils have a higher content of coarse fragments in the upper part than the Cincinnati soil. They are commonly near slope breaks. Guernsey soils contain more clay in the subsoil than the Cincinnati soil. They do not have a fragipan. They are near seepy areas on the upper part of slopes. Included soils make up 10 to 20 percent of most areas.

Permeability is moderate above the fragipan in the Cincinnati soil and moderately slow or slow in and below the fragipan. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during wet periods. Available water capacity is moderate. Runoff is rapid in cultivated areas. The shrink-swell potential is moderate in the fragipan and the lower part of the subsoil. The potential for frost action is high. Unless the soil is limed, the part of the subsoil above the fragipan is very strongly acid or strongly acid.

Most of the acreage is farmed. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay. If the soil is cultivated or if the protective plant cover is removed, the hazard of erosion is severe. The surface layer crusts after hard rains. If conservation measures are used, the soil can be planted to cultivated crops or small grain every other year. A system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, contour stripcropping, diversions, grassed waterways, and cover crops help to prevent excessive crusting and erosion. Tilling within the proper range of moisture content helps to prevent excessive compaction. Maintaining stands of alfalfa is difficult because of the damage caused by frost heaving.

This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

This soil is moderately well suited to buildings. The slope and the seasonal wetness are limitations. The buildings should be designed so that they conform to the natural slope of the land. The more convex parts of slopes are the best sites for buildings. Drainageways and the included seepy spots should not be selected as building sites. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

Because of the slope, the moderately slow or slow permeability, and the seasonal wetness, this soil is poorly suited to septic tank absorption fields. The effluent seeps downslope along the top of the fragipan. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface. The restricted permeability can be overcome by installing the distribution lines as shallow as possible and by alternating the distribution of effluent into two absorption fields. Installing perimeter drains around the absorption fields reduces the seasonal wetness.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 2a.

DkC—Dekalb loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on knolls in the uplands. Most areas have smooth or convex slopes. They range from 3 to 20 acres in size.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil is yellowish brown and friable. The upper part is channery loam, and the lower part is very flaggy sandy loam. Fractured, medium grained sandstone bedrock is at a depth of about 36 inches. The fractures are filled with yellowish brown loamy sand.

Included with this soil in mapping are small areas of Gilpin and Wellston soils near the center of ridgetops. These soils have a lower content of coarse fragments in the subsoil and a higher available water capacity than the Dekalb soil. They make up 10 to 20 percent of most areas.

Permeability is rapid in the Dekalb soil. Available water capacity is very low. Runoff is medium in cultivated areas. The soil dries rapidly following rainfall. The root zone is moderately deep over sandstone bedrock. Unless the soil is limed, the subsoil is strongly acid to extremely acid.

Most areas are used as hayland or pasture. Some are used for cultivated crops. This soil is moderately well suited to row crops and small grain and to grasses and legumes for hay and pasture. Droughtiness generally reduces yields of corn and the last cutting of hay. Controlling erosion, conserving moisture, and increasing the organic matter content are management concerns. If conservation measures are used, a common rotation includes a cultivated or small grain crop every other year. No-till or other systems of conservation tillage that leave crop residue on the surface, a cropping sequence that includes grasses and legumes, a mulch of crop residue, cover crops, and contour stripcropping reduce the hazard of erosion.

This soil is moderately well suited to pasture. It dries out rapidly and thus is suited to grazing early in spring. Because of droughtiness in summer, pastures should be seeded early in spring or late in summer. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Because nutrients are rapidly leached, plants generally respond better to smaller, more frequent applications of fertilizer than to one large application. Because of the acidity and the very low available water capacity, maintaining a stand of deep-rooted legumes is difficult in many areas. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage species.

This soil is moderately well suited to trees. Planting seedlings that have been transplanted once reduces the seedling mortality rate.

Because of the moderate depth to bedrock, the slope, and the stones in the subsoil, this soil is only moderately well suited to buildings. In most areas the bedrock at a depth of 20 to 40 inches interferes with excavation for basements and utility lines. Blasting may be required. Designing the buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Maintaining as much vegetation on the site as possible during construction and reseeding or mulching excavated areas help to control erosion.

This soil is poorly suited to septic tank absorption fields. Because it is not deep enough over bedrock, it cannot adequately filter the effluent. Seepage of effluent into fractures in the underlying bedrock can contaminate underground water supplies. Installing the absorption field in suitable fill material elevates the field a sufficient distance above the bedrock and increases the absorption rate. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 3f.

DkD—Dekalb loam, 15 to 25 percent slopes. This moderately deep, well drained, moderately steep soil is in narrow strips around the upper part of hillsides, on knolls, and along drainageways in the uplands. Most areas have smooth or convex slopes. They range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable loam about 5 inches thick. The subsoil is yellowish brown and friable. The upper part is channery loam, and the lower part is very flaggy sandy loam. Fractured sandstone bedrock is at a depth of about 33 inches. The fractures are filled with yellowish brown loamy sand.

Included with this soil in mapping are a few small areas of severely eroded soils, shallow, very droughty soils, and very stony soils. Included soils are generally near slope breaks. They make up about 15 percent of most areas.

Permeability is rapid in the Dekalb soil. Available water capacity is very low. Runoff is rapid in cultivated areas. The soil dries rapidly following rainfall. It is droughty. The root zone is moderately deep over sandstone bedrock. Unless the soil is limed, the root zone is strongly acid to extremely acid.

A few areas are used as cropland. This soil is poorly suited to row crops and hay. It can be used for small grain and an occasionally grown row crop if erosion is controlled and careful management is applied. In a commonly used rotation, sod crops are grown in 3 out of 4 years. Because of the acidity and the very low available water capacity, maintaining a stand of deep-rooted legumes is difficult in many areas. Droughtiness reduces crop yields. The crops should be planted early in spring or late in summer.

Some areas are pastured. This soil is moderately well suited or poorly suited to pasture. It is well suited to grazing early in spring. If the soil is plowed for reseeding, the hazard of erosion is very severe. Deep tillage is difficult in areas of the shallow and very stony included soils. Conserving moisture and controlling erosion are the major management concerns. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage species. Because nutrients are rapidly leached, plants generally respond better to smaller, more frequent applications of fertilizer than to one large application.

Many areas are wooded. This soil is moderately well suited to trees. Laying out skid trails and logging roads on the contour facilitates the use of equipment. Mechanical planting is difficult in the very stony included areas because of the rock fragments on and below the surface. Planting seedlings that have been transplanted once reduces the seedling mortality rate.

Because of the moderate depth to bedrock, the moderately steep slope, and the stones in the subsoil, this soil is poorly suited to buildings. In most areas the bedrock at a depth of 20 to 40 inches interferes with excavation for basements and utility lines. Blasting may be required. Designing the buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Maintaining as much vegetation on the site as possible during construction and reseeding or mulching excavated areas help to control erosion.

This soil is poorly suited to septic tank absorption fields. Because it is not deep enough over bedrock, it cannot adequately filter the effluent. Seepage of effluent into fractures in the underlying bedrock can contaminate underground water supplies. Installing the absorption field in suitable fill material elevates the field a sufficient distance above bedrock and increases the absorption rate. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

The land capability classification is IVe. The woodland ordination symbol is 3r on north aspects, 4r on south aspects.

DkE—Dekalb loam, 25 to 40 percent slopes. This moderately deep, steep, well drained soil is on hillsides and knolls in the uplands. Except for small drainageways on the hillsides, most areas have smooth slopes. They range from 10 to 50 acres in size.

Typically, the surface layer is black, very friable loam about 3 inches thick. The subsoil is yellowish brown. The upper part is very friable loam and friable channery loam, and the lower part is friable very flaggy sandy loam. Fractured, medium grained sandstone bedrock is at a depth of about 33 inches. The fractures are filled with yellowish brown loamy sand. In some areas the soil is deep to bedrock.

Included with this soil in mapping are a few small areas of massive bedrock outcrops and areas of shallow, very stony soils. Inclusions make up about 20 percent of most areas.

Permeability is rapid in the Dekalb soil. The root zone is moderately deep over sandstone bedrock. Available water capacity is very low. The soil is droughty. Runoff is very rapid if the plant cover has been removed. Unless the soil is limed, the subsoil is strongly acid to extremely acid.

A few areas that have smooth, even slopes are used for hay. This soil generally is unsuited to cropland and hayland.

This soil is poorly suited to permanent pasture. It dries out rapidly and thus is suited to grazing early in spring. The slope limits the use of equipment. If the soil is plowed for reseeding, the hazard of erosion is very severe. Conserving moisture and controlling erosion are the major management concerns. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Maintaining stands of deep-rooted legumes is difficult because of the droughtiness and the acidity. Proper stocking rates, pasture rotation, and mowing to control weeds help to maintain a good stand of the key forage species. Because nutrients are rapidly leached, plants generally respond better to smaller, more frequent applications of fertilizer than to one large application.

Most areas are wooded. This soil is moderately well suited to trees and to habitat for woodland wildlife. Laying out skid trails and logging roads on the contour facilitates the use of equipment. Mechanical planting is very difficult because of the steep slope and the included very stony soils and sandstone outcrops. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and have more moisture available for plant growth because they are less exposed to the sun and the prevailing wind.

This soil generally is unsuited to buildings and septic tank absorption fields. The steep slope, the bedrock at a depth of 20 to 40 inches, and the possible pollution of ground water supplies by septic tank effluent are severe limitations. Laying out trails in recreation areas on the contour reduces the hazard of erosion.

The land capability classification is VIe. The woodland ordination symbol is 3r on north aspects, 4r on south aspects.

DmF—Dekalb loam, 40 to 70 percent slopes, very stony. This moderately deep, very steep, well drained soil is mainly in long narrow strips around hillsides. A few areas are wide and include the entire hillside. Large stones and a few boulders are on the surface. The stones are mostly 10 to 24 inches in diameter and are about 10 to 25 feet apart. Because of downslope movement, considerable mixing of the rock fragments and the soil material has taken place on long slopes. Most areas range from 5 to 100 acres in size.

Typically, the surface layer is black, very friable loam about 3 inches thick. The upper part of the subsoil is yellowish brown, very friable loam and friable channery loam; and the lower part is yellowish brown, friable very flaggy sandy loam. Fractured, medium grained sandstone bedrock is at a depth of about 30 inches. The fractures are filled with yellowish brown loamy sand. In some areas the soil is deep to bedrock.

Included with this soil in mapping are massive sandstone bedrock escarpments, mainly on the middle or upper parts of the slopes. These inclusions make up about 20 percent of most areas.

Permeability is rapid in the Dekalb soil. Available water capacity is very low. The soil is droughty. Runoff is very rapid. The root zone is moderately deep over sandstone bedrock. Unless the soil is limed, the subsoil is strongly acid to extremely acid.

Some areas that were cleared for pasture are reverting to woodland. This soil is generally unsuited to cropland and pasture. The very steep slope, the droughtiness, the stoniness, and the included bedrock outcrops are severe limitations.

Most areas are used as woodland and as habitat for woodland wildlife. This soil is moderately well suited to trees and to habitat for woodland wildlife. Laying out skid trails and logging roads on the contour helps to control erosion and facilitates the use of equipment. Water bars and a vegetative cover also help to control erosion. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and have more moisture available for plant growth because they are less exposed to the prevailing wind and the sun. Harvesting procedures that do not leave the trees widely spaced or isolated help to reduce the windthrow hazard.

This soil generally is unsuited to buildings and septic tank absorption fields because of the very steep slope, the bedrock at a depth of 20 to 40 inches, the stoniness, and the possible pollution of ground water supplies by septic tank effluent. Many areas are scenic lookout points and have potential for some recreational uses. Laying out roads and trails in recreation areas on the contour reduces the hazard of erosion.

The land capability classification is VIIs. The woodland ordination symbol is 3r on north aspects, 4r on south aspects.

Ds—Dumps, mine. This map unit consists mostly of steep and very steep ridges or cone-shaped piles of waste material from deep coal mining. This material is mainly soft, impure coal and black, carbonaceous roof shale that originally had a relatively high content of sulfur compounds. The material is locally referred to as "mine gob," "gob," or "gob piles." Some areas have burned or have oxidized with time and consist of hard, red to gray, shaly or gravelly material known as "red dog." Slopes are mostly steep or very steep, but in a few areas they have graded tops that are nearly level to strongly sloping.

This material was acid when mined. The oxidized material is medium acid to neutral. Poor physical properties of both the burned and unburned material adversely affect plant growth, and most areas are bare. A few areas have been covered with soil material and support plants. The mine gob has a high content of organic carbon but has a very low content of the organic matter characteristic of natural soils. The oxidized material is very low in content of organic carbon and does not contain organic matter. Both the mine gob and the oxidized material have a low or very low available water capacity. Water percolating through the ultra acid material can pollute local streams in many areas.

Reclaiming abandoned areas helps to control erosion, sedimentation, and acid drainage. The best suited grasses and trees are those that can withstand a low available water capacity and acid conditions. Some areas could be developed as openland wildlife habitat. The red dog is a source of surface material for township roads and driveways.

No land capability classification or woodland ordination symbol is assigned.

EnE—Enoch shaly clay loam, 20 to 40 percent slopes. This deep, well drained, moderately steep and steep soil is on mine-spoil ridges in areas that formerly were surface mined for coal. Most areas have a highwall. They consist of a series of spoil ridges that have narrow tops and steep side slopes. Intermittent pools of water are between some of the ridges. Most areas have not been graded. The soil is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. The rock fragments, mostly flat and subrounded, are carbonaceous shale, coal, and smaller amounts of sandstone. A few stones and boulders are in some areas, generally below the surface. Most areas are 25 to 150 acres in size.

Typically, the surface layer is grayish brown, friable, shaly clay loam about 1 inch thick. The substratum to a depth of about 80 inches is light gray, gray, and light olive brown, friable, extremely shaly, very shaly, and shaly silty clay loam. In places the substratum has layers that contain more sand and less clay.

Included with this soil in mapping are small areas of the Bethesda soils. These soils are strongly acid to extremely acid in the substratum. They support poor or fair stands of vegetation. Also included are a few small areas that are very stony or very bouldery and some narrow troughs and nearly level pits between the ridges. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in the Enoch soil. Runoff is very rapid. Available water capacity is low. The potential for frost action is moderate. The soil has a highly corrosive effect on uncoated steel and concrete. The substratum is ultra acid throughout. The root zone is restricted to the upper few inches of the soil.

Nearly all areas are left idle. This soil is too acid for most kinds of vegetation. It generally is unsuited to cropland, pasture, and woodland. Erosion and sedimentation in drainageways are severe hazards. The stones in some included areas interfere with the use of equipment. A plant cover reduces the hazards of erosion and water contamination. Applications of a large amount of lime, fertilizer, sewage sludge, or fly ash help to provide a better zone for plant growth. Blanketing the soil with suitable soil material also helps to provide a more favorable root zone. Reclaimed areas are suited to grasses and trees and to habitat for wildlife, but careful management is needed.

This soil generally is unsuited to buildings and septic tank absorption fields. The slope, the unstable fill, the moderately slow permeability, and the high risk of corrosion are severe limitations.

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

EuA—Euclid silt loam, rarely flooded. This deep, nearly level, somewhat poorly drained soil is on low stream terraces. Slopes are typically smooth. They are 0 to 3 percent. Most areas are 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is yellowish brown, brown, and dark yellowish brown, mottled, friable silt loam and silty clay loam about 40 inches thick. The substratum to a depth of about 80 inches is dark yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the very poorly drained Luray soils in small depressions. These soils make up about 15 percent of most areas.

Permeability is moderately slow in the Euclid soil. Runoff is slow. Available water capacity is high. If the soil is adequately drained, the root zone is deep. A seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. The potential for frost action is high. Unless the soil is limed, the subsoil is medium acid to very strongly acid.

Most areas are farmed. In drained areas this soil is well suited to intensively grown corn, small grain, and hay. Yields are reduced in wet periods. Subsurface drains are effective in lowering the seasonal high water table. Diversions and grassed waterways are commonly used in areas that receive runoff from the higher adjacent soils. Erosion is a moderate hazard if long slopes are cultivated. The surface layer crusts after hard rains. Maintaining tilth and the organic matter content are management concerns. Applying a system of conservation tillage that leaves crop residue on the surface and incorporating crop residue into the plow layer help to control erosion and improve tilth. Tilling within the proper range of moisture content helps to prevent excessive surface compaction and crusting.

A few areas are pastured. This soil is well suited to pasture but is poorly suited to grazing early in spring. It is well suited to Kentucky bluegrass, tall fescue, ladino clover, alsike clover, birdsfoot trefoil, and reed canarygrass. Because of the seasonal wetness and the high potential for frost action, maintaining stands of deep-rooted legumes is difficult. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to keep the pasture in good condition. Restricted grazing during extended wet periods helps to prevent excessive compaction.

Only a small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

This soil is generally unsuited to buildings and septic tank absorption fields. The seasonal wetness, the rare flooding, and the moderately slow permeability are severe limitations. Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIw. The woodland ordination symbol is 2a.

FbD—Fairpoint channery clay loam, 8 to 20 percent slopes. This strongly sloping and moderately steep, deep, well drained soil is mainly on the tops and sides of mine-spoil ridges in areas that formerly were surface mined for coal. Most areas have not been graded. Slopes are dominantly 8 to 15 percent. They generally are smooth, but small gullies have formed in eroded areas. The soil is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. Rock fragments are mostly siltstone, neutral or calcareous shale, and fine grained sandstone. Small amounts of coal and carbonaceous roof shale are in most areas. Most areas are 10 to 50 acres in size.

Typically, the surface layer is olive, firm channery clay loam about 5 inches thick. The substratum to a depth of about 80 inches is variegated olive, olive brown, grayish brown, light olive brown, and yellowish brown, firm very channery clay loam. In some areas the substratum is more acid.

Included with this soil in mapping are small areas that have boulders and large stones on the surface and throughout the profile. Also included, on the top of the spoil ridges, are small areas that have a slope of 0 to 8 percent. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Fairpoint soil. Runoff is rapid or very rapid. The depth of the root zone can vary within short distances because of differences in the size and content of coarse fragments and the compactness of the material. Available water capacity is low. The potential for frost action and the shrink-swell potential are moderate. The organic matter content is very low. Unless the soil is limed, the substratum is medium acid to neutral.

A small acreage is used for grasses and legumes. Because of the restricted root zone, the slope, the low available water capacity, and the very low organic matter content, this soil generally is unsuited to the commonly grown row crops and small grain. It is poorly suited to hay and pasture. The rock fragments on or in the surface layer seriously interfere with tillage. Erosion is a very severe hazard if the soil is cultivated. A plant cover and surface mulch conserve moisture and reduce the hazards of runoff and erosion. Pasture rotation and proper stocking rates help to maintain a good stand of forage species. Restricted grazing during extended wet periods helps to prevent excessive compaction. Most areas have potential reservoir sites for livestock water.

Most of the acreage is wooded, mainly with low-quality hardwoods. This soil is suited to trees, but growth is generally slow because of the very low organic matter content and the low available water capacity. Grasses and legumes provide a ground cover during the establishment of tree seedlings. Rock fragments in and on the surface layer limit the use of mowing and planting equipment.

Onsite investigation is needed to determine the suitability of this soil for buildings. Once the soil has settled, convex areas where slopes are 8 to 15 percent are moderately well suited or poorly suited to buildings. Drainageways, concave slopes, and areas that have buried trees and other organic material beneath the surface are unsuitable as sites for buildings. Areas where slopes are 15 to 20 percent and most areas on spoil outslopes where the slope is 15 to 20 percent are unsuited to buildings and septic tank absorption fields. The thickness of the soil over bedrock and the need to control storm water runoff should be considered during site investigations. Designing buildings so that they conform to the natural slope of the land minimizes cutting, filling, land shaping, and the possibility of hillside slippage.

Because of the restricted root zone, droughtiness adversely affects lawns. Small stones interfere with mowing. Sites for lawns should be blanketed with suitable soil material, which provides a more favorable root zone, increases the available water capacity, and covers small stones. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

Because of the slope, the moderately slow permeability, and the unstable fill, this soil is poorly suited to septic tank absorption fields. The moderately slow permeability can be overcome by installing the absorption field in suitable fill material and by alternating the distribution of effluent into two absorption fields. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

This soil has a highly corrosive effect on uncoated steel and a moderately corrosive effect on concrete. Heavy-duty PVC or coated steel pipe should be used in drainage and sewer lines. High-quality polyethylene pipe should be used in water lines.

The unstable fill is a limitation on sites for driveways and for local roads and streets. Onsite investigation is needed to determine the suitability of the soil for these uses. Designing the driveways, roads, and streets so that water does not collect and flow in unpaved areas helps to control erosion.

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

FbF—Fairpoint channery clay loam, 40 to 70 percent slopes. This very steep, deep, well drained soil is on mine-spoil side slopes in areas that formerly were surface mined for coal. It is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. Rock fragments are mostly siltstone, neutral or calcareous shale, and fine grained sandstone and smaller amounts of carbonaceous roof shale and coal. Most areas are cone shaped, are narrow ridges of mine spoil, or are on the outer slopes where the spoil was placed on hillsides. Other areas are ridges adjacent to highwalls. They contain long, narrow pools of water. Most areas have not been graded. A few flat, rounded stones generally are on and below the surface. Most areas range from about 20 to 100 acres in size.

Typically, the surface layer is olive, firm channery clay loam about 5 inches thick. The substratum to a depth of about 80 inches is yellowish brown, grayish brown, olive, olive brown, and light olive brown, firm very channery clay loam. In some areas the substratum is more acid.

Included with this soil in mapping are small areas of Enoch soils. These soils are ultra acid throughout and are bare of vegetation. Also included are small areas that have boulders and large stones on the surface. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Fairpoint soil. Runoff is very rapid. The depth of the root zone can vary within short distances because of differences in the size and content of coarse fragments and the compactness of the material. Available water capacity is low. The organic matter content is very low. The shrink-swell potential and the potential for frost action are moderate. The substratum is medium acid to neutral.

This soil generally is unsuited to cropland and pasture because of the very steep slope, a very severe hazard of erosion, and droughtiness.

Most areas are wooded. A cover of woody vegetation helps to control erosion. Trees grow slowly. Mechanical planting and mowing are not practical because of the very steep slope and the rock fragments in the surface layer.

This soil generally is unsuited to buildings and septic tank absorption fields because of the very steep slope, the unstable fill, and the moderately slow permeability. Some of the long, narrow pools of water may have potential for recreational uses.

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

FtA—Fitchville silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on terraces along streams. Most areas are long and narrow or are irregular in shape. They range from 3 to 10 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is grayish brown, mottled, friable silt loam about 3 inches thick. The subsoil is yellowish brown, mottled, friable and firm silt loam and silty clay loam about 48 inches thick. The substratum to a depth of about 80 inches is yellowish brown, mottled, friable silty clay loam.

Included with this soil in mapping are small areas of the very poorly drained Luray soils in slight depressions and along drainageways. These soils make up about 15 percent of most areas.

Permeability is moderately slow in the Fitchville soil. Runoff is slow. Available water capacity is high. The root zone is deep if the soil is drained. A seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. The shrink-swell potential is moderate in the subsoil, and the potential for frost action is high. Unless the soil is limed, reaction is medium acid to very strongly acid in the upper part of the subsoil and medium acid to neutral in the lower part.

Most areas are drained and farmed. In drained areas this soil is well suited to intensively grown corn, soybeans, small grain, and hay. Yields are reduced somewhat in wet periods. Subsurface drains are effective in lowering the water table. Diversions are used in areas that receive runoff and seepage from the higher adjacent soils. The surface layer crusts after hard rains. Applying a system of conservation tillage that leaves crop residue on the surface, planting cover crops, and including forage crops in the cropping sequence help to maintain tilth and the organic matter content and increase the rate of water infiltration. Tilling within the proper range of moisture content helps to prevent excessive surface crusting and compaction. Drained areas are suited to no-till, but planting is generally delayed by wetness.

Some areas are pastured. This soil is well suited to pasture, but is poorly suited to grazing early in spring. It is well suited to Kentucky bluegrass, tall fescue, ladino clover, alsike clover, birdsfoot trefoil, and reed canarygrass. Because of the seasonal wetness and the high potential for frost action, maintaining stands of deep-rooted legumes is difficult. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to keep the pasture in good condition. Restricted grazing during extended wet periods helps to prevent excessive compaction.

Only a small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

This soil is poorly suited to buildings and septic tank absorption fields because of the seasonal wetness and the moderately slow permeability. Subsurface drains and open ditches reduce the wetness. Agricultural drainage outlets generally cannot carry all of the excess water from residential areas. Building sites should be landscaped so that surface water flows away from the absorption fields and the foundations. In some places diversions intercept runoff from the higher adjacent soils. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Installing perimeter drains around septic tank absorption fields lowers the seasonal high water table. Widening the bottom of the trench in the distribution lines helps to overcome the restricted permeability. Excavation is limited during winter and spring because of wetness.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIw. The woodland ordination symbol is 2a.

GdC—Gilpin silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on narrow or rounded ridgetops, on knolls, and in a few narrow strips along the edge of wide, gently sloping ridgetops. Slopes generally are smooth, except for those in dissected areas in a few shallow drainageways near the edge of some ridgetops. Most areas range from 3 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 3 inches thick. The subsurface layer also is very friable silt loam about 3 inches thick. It is pale brown. The subsoil is about 16 inches thick. The upper part is brown, friable silt loam and silty clay loam, and the lower part is brown, firm channery and very channery silty clay loam. The substratum is brown, firm extremely channery silt loam. Fractured siltstone bedrock is at a depth of about 37 inches. In places the bedrock is not fractured. In some areas the soil is deep to bedrock.

Included with this soil in mapping are small areas of the deep Wellston soils near the center of the wider ridgetops. Also included are a few narrow strips of Dekalb soils near slope breaks on some ridgetops. These soils are more droughty than the Gilpin soil. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Gilpin soil. Available water capacity is low. Runoff is rapid in cultivated areas. The potential for frost action is moderate. The root zone is moderately deep over bedrock. Unless the soil is limed, the subsoil is strongly acid to extremely acid.

A few areas are used as cropland. Because of the slope and droughtiness, this soil is only moderately well suited to cultivated crops and small grain. If the soil is cultivated or the protective plant cover is removed, the hazard of erosion is severe. Controlling erosion, conserving moisture, and maintaining tilth and the organic matter content are management concerns. A common rotation includes a cultivated or small grain crop every other year. The soil is well suited to no-till. No-till and other systems of conservation tillage that leave crop residue on the surface, a cropping sequence that includes grasses and legumes, cover crops, and contour stripcropping help to conserve moisture and reduce the hazard of erosion. Tilling within the proper range of moisture content helps to prevent excessive compaction.

Many areas are pastured. This soil is well suited to grasses and legumes for pasture and hay. Because of the acid subsoil and the potential for frost action, maintaining stands of deep-rooted legumes is difficult in many areas. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage species. Restricted grazing during extended wet periods helps to prevent excessive compaction.

Many areas are used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

Because of the moderate depth to bedrock and the slope, this soil is only moderately well suited to buildings. The ridgetops and the more convex parts of slopes are the best sites for buildings. Drainageways should not be selected as building sites. In most areas the bedrock at a depth of 20 to 40 inches interferes with excavation for basements and utility lines, but blasting is not generally required. Designing the buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Maintaining as much vegetation on the site as possible during construction and reseeding or mulching excavated areas reduce the risk of erosion.

This soil is poorly suited to septic tank absorption fields. Because it is not deep enough over bedrock, it cannot adequately filter the effluent. Seepage of effluent into fractures in the underlying bedrock can contaminate underground water supplies. Installing the absorption field in suitable fill material elevates the field a sufficient distance above the bedrock and increases the absorption rate. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

Frost action and the slope are limitations on sites for local roads and streets. The damage caused by frost action can be minimized by providing suitable base material. The roads and streets should be built on the contour.

The land capability classification is IIIe. The woodland ordination symbol is 2a.

GdD—Gilpin silt loam, 15 to 25 percent slopes. This moderately deep, well drained, moderately steep soil is in strips around hillsides, on narrow, rounded ridgetops; on knolls on wide ridgetops; and in a few narrow strips along the edge of wide ridgetops. Slopes are generally smooth, except for those in dissected areas in a few shallow drainageways on hillsides. Most areas range from 3 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 3 inches thick. The subsurface layer also is very friable silt loam about 3 inches thick. It is pale brown. The subsoil is about 16 inches thick. The upper part is brown, friable silt loam and silty clay loam, and the lower part is brown, firm channery and very channery silty clay loam. The substratum is brown, firm extremely channery silt loam. Fractured siltstone bedrock is at a depth of about 37 inches. In places the bedrock is not fractured. In some areas the soil is deep to bedrock.

Included with this soil in mapping are some narrow strips of Dekalb soils near slope breaks on ridgetops. These soils are more droughty than the Gilpin soil. Also, they have a higher content of sand and coarse fragments in the subsoil. They make up about 15 percent of most areas.

Permeability is moderate in the Gilpin soil. Available water capacity is low. Runoff is rapid in cultivated areas. The potential for frost action is moderate. The root zone is moderately deep over bedrock. Unless the soil is limed, the subsoil is strongly acid to extremely acid.

A few areas are cultivated. This soil is poorly suited to row crops and small grain and is moderately well suited to hay. A commonly used rotation includes a cultivated crop about once every 4 years. The soil is droughty during extended dry periods. The hazard of erosion is very severe. Controlling erosion and maintaining the organic matter content are management concerns. No-till or other systems of conservation tillage that leave crop residue on the surface, incorporation of crop residue into the plow layer, a cropping sequence that includes grasses and legumes, contour stripcropping, cover crops, diversions, and grassed waterways reduce the hazard of erosion. Tilling within the proper range of moisture content helps to prevent excessive compaction. Because of the acid subsoil and the potential for frost action, maintaining stands of deep-rooted legumes is difficult in many areas.

Many areas are pastured. This soil is moderately well suited to pasture. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage species. Restricted grazing during extended wet periods helps to prevent excessive compaction.

Many areas are wooded. This soil is moderately well suited to trees. Mowing, spraying, and disking help to control plant competition. Laying out skid trails and logging roads on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also help to control erosion. Coves and north- and east-facing slopes are the best sites for woodland. These sites have cooler temperatures and have more moisture available for plant growth because they are less exposed to the prevailing wind and the sun. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south-facing slopes.

This soil is poorly suited to buildings. The moderate depth to bedrock and the moderately steep slope are limitations. The narrow ridgetops and the more convex parts of slopes are the best sites for buildings. Drainageways should not be selected as building sites. In most areas the bedrock at a depth of 20 to 40 inches interferes with excavation for basements and utility lines, but blasting is not generally required. Designing the buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Constructing driveways across the slope and designing them so that water does not collect and flow in unpaved areas help to control erosion. Maintaining as much vegetation on the site as possible during construction and reseeding or mulching excavated areas also help to control erosion.

Because of the moderately steep slope and the bedrock at a depth of 20 to 40 inches, this soil is poorly suited to septic tank absorption fields. It cannot adequately filter the effluent because it is not deep enough over bedrock. Seepage of effluent into the fractures in the underlying bedrock can contaminate underground water supplies. Installing the absorption field in suitable fill material elevates the field a sufficient distance above the bedrock and increases the absorption rate. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

The land capability classification is IVe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

GnB—Glenford silt loam, 1 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on smooth slopes on terraces along streams. Most areas are blocky or irregular in shape. They range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 48 inches of yellowish brown and dark grayish brown, mottled, friable silt loam and firm silty clay loam. The substratum to a depth of about 80 inches is yellowish brown, mottled, friable, stratified silt loam and silty clay loam. In some places the lower part of the subsoil is compact and slowly permeable.

Included with this soil in mapping are narrow strips of the somewhat poorly drained Fitchville soils near drainageways. Also included are spots of the very poorly drained Luray soils in slight depressions and along drainageways. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in the Glenford soil. Runoff is medium. The root zone is deep. Available water capacity is high. A seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. The shrink-swell potential is moderate in the upper part of the subsoil. The potential for frost action is high. Unless the soil is limed, reaction is very strongly acid to medium acid in the upper part of the subsoil and medium acid to neutral in the lower part.

Most of the acreage is farmed. This soil is well suited to corn, soybeans, and small grain and to most grasses and legumes for hay. Deep-rooted legumes are subject to frost heaving. Controlling erosion, preventing excessive crusting, and draining the wetter included soils are management concerns. A cropping sequence that includes grasses and legumes, grassed waterways, contour tillage, contour stripcropping on the longer slopes, conservation tillage, incorporation of crop residue into the plow layer, and cover crops increase the rate of water infiltration and help to prevent excessive crusting and erosion. Subsurface drains are needed in the wetter included soils. In some areas diversions are needed to intercept runoff from adjacent slopes.

Some areas are pastured. This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

Because of the seasonal wetness and the moderate shrink-swell potential, this soil is only moderately well suited to buildings. The higher or more convex parts of slopes are the best sites for buildings. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. In some areas diversions that intercept runoff from the higher adjacent soils reduce the wetness. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

This soil is moderately well suited to septic tank absorption fields. The moderately slow permeability and the seasonal wetness are the main limitations. Installing perimeter drains around the absorption fields lowers the seasonal high water table. The moderately slow permeability can be overcome by alternating the distribution of effluent into two absorption fields or by widening the bottom of the trench in the absorption fields.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIe. The woodland ordination symbol is 1a.

GwC—Guernsey-Westmoreland silt loams, 8 to 15 percent slopes. These deep, strongly sloping soils are on rounded ridgetops, on knolls on wide ridgetops, and on a few side slopes. The Guernsey soil is moderately well drained and the Westmoreland soil well drained. Slopes are mainly smooth or slightly convex. Areas on rounded ridgetops and on side slopes are long and narrow, and those on knolls are circular. Most areas range from 5 to 50 acres in size. They generally are about 50 percent Guernsey soil and 30 percent Westmoreland soil. The Westmoreland soil, however, is dominant in some areas. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Guernsey soil has a brown, friable silt loam surface layer about 7 inches thick. The subsurface layer also is brown, friable silt loam about 7 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is light olive brown, mottled, firm silty clay loam. The substratum is dark yellowish brown, mottled, firm silty clay loam. Gray, calcareous shale bedrock is at a depth of about 62 inches.

Typically, the Westmoreland soil has a brown, friable silt loam surface layer about 5 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown and brown, friable silt loam, and the lower part is brown, firm channery and very channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Hard, olive brown siltstone bedrock is at a depth of about 43 inches. In some areas the soil is moderately deep to bedrock.

Included with these soils in mapping are small areas of Westmore soils. These included soils are more silty in the upper part than the Guernsey and Westmoreland soils. They are typically in the less sloping areas near the center of ridgetops and saddles. Also included are a few severely eroded areas where the surface layer is channery silt loam or silty clay loam. Included soils make up about 20 percent of most areas.

Permeability is moderately slow or slow in the Guernsey soil and moderate in the Westmoreland soil. A seasonal high water table is at a depth of 24 to 42 inches in the Guernsey soil. Available water capacity is moderate in the Guernsey soil and low or moderate in the Westmoreland soil. Runoff is rapid on both soils. The shrink-swell potential is high in the Guernsey soil and low in the Westmoreland soil. The potential for frost action is high in the Guernsey soil and moderate in the Westmoreland soil. Unless lime has been applied, the subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is extremely acid to medium acid in the upper part of the subsoil and strongly acid to moderately alkaline in the lower part.

A few areas are used as cropland. These soils are moderately well suited to corn, soybeans, and small grain and are well suited to grasses and legumes for hay. A common rotation includes a cultivated or small grain crop every other year. Maintaining stands of deep-rooted legumes is difficult in many areas because of the acid subsoil and the potential for frost action. The hazard of erosion is severe in cultivated areas. Controlling erosion and maintaining tilth and the organic matter content are management concerns. Applying a system of conservation tillage that leaves crop residue on the surface, including grasses and legumes in the cropping sequence, returning crop residue to the soil, contour stripcropping, planting cover crops, and establishing grassed waterways reduce the hazard of erosion and help to maintain tilth and the organic matter content. Tilling within the proper range of moisture content helps to prevent excessive compaction.

Many areas are pastured. These soils are well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

Many areas are wooded. These soils are moderately well suited to trees and are well suited to habitat for woodland wildlife. Mowing, spraying, and disking help to control plant competition. Removing vines and the less desirable trees and shrubs also helps to control plant competition.

These soils are moderately well suited to buildings. The Westmoreland soil is better suited than the Guernsey soil. The slope of both soils, the depth to bedrock in the Westmoreland soil, and the seasonal wetness and high shrink-swell potential of the Guernsey soil are limitations. Designing walls that have pilasters, reinforcing walls and foundations, and backfilling along basement walls with material that has a low shrink-swell potential help to prevent the 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. Designing buildings so that they conform to the natural slope of the land minimizes cutting, filling, or land shaping. The bedrock underlying these soils generally is siltstone and shale, which can be excavated with heavy equipment. In some areas of the Westmoreland soil, however, the bedrock is sandstone, which requires blasting. Reseeding or mulching during construction reduces the hazard of erosion.

Because of the slope, the seasonal wetness, and the restricted permeability, these soils are only moderately well suited to septic tank absorption fields. The Westmoreland soil is better suited than the Guernsey soil. Installing interceptor drains upslope from the absorption field reduces the seasonal wetness. The restricted permeability can be overcome by alternating the distribution of effluent into two absorption fields or by installing the absorption fields in suitable fill material. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

Low strength, frost action, and slope are limitations on sites for local roads and streets. The damage caused by low strength and frost action can be minimized by providing suitable base material and by installing a drainage system. Building the roads and streets across the slope helps to control erosion and reduces the gradient.

The land capability classification is IIIe. The woodland ordination symbol is 2a for the Guernsey soil and 3a for the Westmoreland soil.

GwD—Guernsey-Westmoreland silt loams, 15 to 25 percent slopes. These deep, moderately steep soils are on the upper part of hillsides and on narrow ridgetops, hillside benches, and rounded knolls. The Guernsey soil is moderately well drained and the Westmoreland soil well drained. Slopes are mainly smooth but are irregular along a few small drainageways. Most areas range from 10 to 100 acres in size. They generally are about 45 percent Guernsey soil and 35 percent Westmoreland soil. The Westmoreland soil, however, is dominant in some areas. The two soils occur as areas so intricately mixed or so narrow that mapping them separately is not practical.

Typically, the Guernsey soil has a brown, friable silt loam surface layer about 6 inches thick. The subsurface layer is pale brown, friable silt loam about 8 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is light olive brown and yellowish brown, mottled, firm silty clay loam. The substratum is dark yellowish brown, mottled, firm silty clay loam. Gray, calcareous shale bedrock is at a depth of about 62 inches. In some areas the depth to bedrock is more than 80 inches. In a few areas the subsoil is redder.

Typically, the Westmoreland soil has a brown, friable silt loam surface layer about 5 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown and brown, friable silt loam, and the lower part is brown, firm channery and very channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Hard, olive brown siltstone bedrock is at a depth of about 43 inches.

Included with these soils in mapping are small areas of somewhat poorly drained soils on concave slopes and near seepy spots and a few areas of Westmore soils on the less sloping parts of the landscape and in saddles on ridgetops. Westmore soils are more silty in the upper part than the Guernsey and Westmoreland soils. Also included are severely eroded soils, which are mainly near slope breaks and on the upper part of hillsides. Included soils make up about 20 percent of most areas.

Permeability is moderately slow or slow in the Guernsey soil and moderate in the Westmoreland soil. A seasonal high water table is at a depth of 24 to 42 inches in the Guernsey soil. Available water capacity is moderate in the Guernsey soil and low or moderate in the Westmoreland soil. Runoff is very rapid in cultivated and severely eroded areas of both soils. The potential for frost action is high in the Guernsey soil and moderate in the Westmoreland soil. The shrink-swell potential is low in the Westmoreland soil and high in the Guernsey soil. Unless lime has been applied, the subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is extremely acid to medium acid in the upper part of the subsoil and strongly acid to moderately alkaline in the lower part.

A few areas are used as cropland. These soils are poorly suited to intensive cropping. They are moderately well suited to small grain and hay and to an occasionally grown row crop. A commonly used rotation includes cultivated crops once every 4 years. Maintaining a stand of deep-rooted legumes is difficult in many areas because of the acid subsoil and the potential for frost action. The hazard of erosion is very severe in cultivated areas. A system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, grassed waterways, contour stripcropping, and cover crops reduce the hazard of erosion. Subsurface drains help to remove excess water in the wetter included soils. Tilling within the proper range of moisture content helps to prevent excessive compaction.

Some areas are pastured. These soils are moderately well suited to pasture. If the pasture is overgrazed or the soils are plowed during seedbed preparation, the hazard of erosion is very severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction and erosion.

Most of the acreage is wooded (fig. 3). These soils are moderately well suited to trees and are well suited to habitat for woodland wildlife. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also help to control erosion. The slope somewhat limits the use of equipment; however, mechanical mowing and spraying equipment can be used to control weeds. Planting seedlings that have been transplanted once reduces the seedling mortality rate in areas of the Guernsey soil on south-facing slopes. Removing vines and the less desirable trees and shrubs helps to control plant competition. Coves and north- and east-facing slopes are the best woodland sites. These sites have more moisture available for plant growth and have cooler temperatures because they are less exposed to the prevailing wind and the sun.

These soils are poorly suited to buildings because of the slope of both soils and the seasonal wetness, susceptibility to hillside slippage, and high shrink-swell potential of the Guernsey soil. The ridgetops and more convex parts of slopes generally are the best sites for buildings. Concave areas, the lower parts of slopes, drainageways, and seepy areas should not be selected as building sites.

Buildings should be designed so that they conform to the natural slope of the land. Excessive cutting and filling in areas of the Guernsey soil increase the hazard of hillside slippage. Improperly disposing of the water that runs off roofs and of the purified effluent from septic tank absorption fields also increases this hazard. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Designing walls that have pilasters, reinforcing walls and foundations, and backfilling along basement walls with material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Erosion can be controlled by reseeding or mulching

Figure 3.—Natural reforestation in an area of Guernsey-Westmoreland silt loams, 15 to 25 percent slopes, on a south-facing slope.

excavated areas and by keeping excess water from collecting and flowing on unpaved roadways.

These soils are poorly suited to septic tank absorption fields because of the slope of both soils and the seasonal wetness and slow or moderately slow permeability of the Guernsey soil. The Westmoreland soil is better suited than the Guernsey soil. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface. Installing interceptor drains upslope from the absorption field reduces the seasonal wetness of the Guernsey soil. Because of the slow or moderately slow permeability, aeration systems can be used in the Guernsey soil.

Low strength, frost action, and slope are limitations on sites for local roads and streets. The damage caused by low strength and frost action can be minimized by providing suitable base material and by installing a drainage system. Building the roads and streets across the slope helps to control erosion and reduces the gradient.

The land capability classification is IVe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

GwE—Guernsey-Westmoreland silt loams, 25 to 40 percent slopes. These deep, steep soils are on hillsides. The Guernsey soil is moderately well drained and the Westmoreland soil well drained. Slopes are generally smooth but are irregular along drainageways in some areas. Most areas are 10 to 100 acres in size. They generally are about 45 percent Guernsey soil and 35 percent Westmoreland soil. The two soils occur as areas so narrow or so small that mapping them separately is not practical.

Typically, the Guernsey soil has a very dark grayish brown, very friable silt loam surface layer about 3 inches thick. The subsurface layer is brown and pale brown, friable silt loam about 11 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, mottled, friable silt loam, and the lower part is light olive brown and yellowish brown, mottled, firm silty clay loam. The substratum is dark yellowish brown, mottled, firm silty clay loam. Gray, calcareous shale bedrock is at a depth of about 62 inches. In some areas the depth to bedrock is more than 80 inches. In a few areas the subsoil is redder.

Typically, the Westmoreland soil has a very dark grayish brown, very friable silt loam surface layer about 2 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown and brown, friable silt loam, and the lower part is brown, firm channery and very channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Hard, olive brown siltstone bedrock is at a depth of about 43 inches. In places the subsoil has a higher content of coarse fragments. In a few areas the soil is moderately deep to bedrock.

Included with these soils in mapping are small areas of somewhat poorly drained soils around seepy spots. Also included are small areas of Westmore soils on narrow benches and on the lower part of slopes. These soils are more silty in the upper part than the Guernsey and Westmoreland soils. Included soils make up about 20 percent of most areas.

Permeability is moderately slow or slow in the Guernsey soil and moderate in the Westmoreland soil. A seasonal high water table is at a depth of 24 to 42 inches in the Guernsey soil. Available water capacity is moderate in the Guernsey soil and low or moderate in the Westmoreland soil. Runoff is very rapid on both soils. The shrink-swell potential is high in the Guernsey soil and low in the Westmoreland soil. The potential for frost action is high in the Guernsey soil and moderate in the Westmoreland soil. Unless lime has been applied, the Guernsey soil is extremely acid to medium acid in the upper part of the subsoil and strongly acid to moderately alkaline in the lower part. The Westmoreland soil is very strongly acid to medium acid in the subsoil.

Some of the smoother areas are used for improved pasture and hay. These soils generally are unsuited to cropland and are poorly suited to pasture. The slope limits the use of equipment. If the pasture is overgrazed or the soils are cultivated during seedbed preparation, the hazard of erosion is very severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods help to prevent excessive compaction. Maintaining stands of deep-rooted legumes is difficult in many areas.

Most areas are wooded. These soils are moderately well suited to trees and are well suited to habitat for woodland wildlife. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also reduce the hazard of erosion. Planting seedlings that have been transplanted once reduces the seedling mortality rate in areas of the Guernsey soil on south-facing slopes. Removing vines and the less desirable trees and shrubs helps to control plant competition. The steep slope limits the use of planting and mowing equipment. Coves and north- and east-facing slopes are the best woodland sites. These sites have more moisture available for plant growth and have cooler temperatures because they are less exposed to the prevailing wind and the sun.

These soils generally are unsuited to buildings and septic tank absorption fields, mainly because of the steep slope. Other limitations, in areas of the Guernsey soil, are a risk of hillside slippage, the seasonal wetness, the high shrink-swell potential, and the moderately slow or slow permeability. Slippage is especially a hazard in concave areas and on the lower slopes. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

Low strength, frost action, and slope are limitations on sites for local roads and streets. The damage caused by low strength and frost action can be minimized by providing suitable base material and by installing a drainage system. Building the roads and streets across the slope helps to control erosion and reduces the gradient.

The land capability classification is VIe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

HaD2—Homewood-Westmoreland silt loams, 15 to 25 percent slopes, eroded. These deep, moderately steep soils are on hillsides. They are mainly on side slopes along small drainageways or on slope breaks to the uplands. A few areas are on knolls on hilltops. The Homewood soil is moderately well drained and well drained, and the Westmoreland soil is well drained. Erosion has removed part of the original surface layer of both soils. The remaining surface layer is a mixture of the original surface layer and subsoil material. Slopes are commonly uniform but are irregular along drainageways. Most drainageways are shallow, but a few are deeply entrenched. Most areas are 10 to 50 acres in size.

Most areas of this map unit are about 45 percent Homewood soil and 30 percent Westmoreland soil. The Westmoreland soil, however, is dominant in some areas. The Homewood soil is commonly on the lower slopes in coves and in areas deeply dissected by drainageways. In most areas it has a few quartzite, chert, flint, and rounded sandstone fragments on the surface. The Westmoreland soil is dominant on the upper slopes. It commonly has small sandstone fragments on the surface. The two soils occur as areas so narrow or so intricately mixed that mapping them separately is not practical.

Typically, the Homewood soil has a dark yellowish brown, friable silt loam surface layer about 7 inches thick. The subsoil is about 61 inches thick. The upper part is brown and yellowish brown, friable silt loam and loam; the next part is a fragipan of yellowish brown, mottled, very firm, dense clay loam; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 80 inches is yellowish brown, dark yellowish brown, and dark reddish brown, mottled, firm clay loam and friable loam. In a few places lacustrine sediments are in the substratum.

Typically, the Westmoreland soil has a brown, friable silt loam surface layer about 5 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown and brown, friable silt loam, and the lower part is brown, firm channery and very channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Hard, olive brown siltstone bedrock is at a depth of about 43 inches. In places the subsoil has a few glacial till pebbles.

Included with these soils in mapping are narrow bands of Guernsey soils. These included soils have more clay in the subsoil than the Homewood and Westmoreland soils. They are commonly below seepy spots. They make up about 25 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. It is moderate in the Westmoreland soil. Runoff is very rapid on both soils. The Homewood soil has a seasonal high water table at a depth of 32 to 48 inches during extended wet periods. Available water capacity is low in the Homewood soil and low or moderate in the Westmoreland soil. The potential for frost action is moderate in both soils. Unless lime has been applied, the subsoil of the Homewood soil is very strongly or strongly acid and the subsoil of the Westmoreland soil is medium acid to very strongly acid.

Most of the acreage is used as pasture and hayland. These soils are poorly suited to row crops grown year after year. Areas where slopes are smooth, however, can be used for an occasionally grown cultivated crop and for small grain or hay if conservation measures are applied. In a commonly used rotation, sod crops are grown in 3 out of 4 years. Areas where slopes are rough and uneven and drainageways are deep are best suited to permanent pasture or woodland. Controlling erosion and draining the included Guernsey soils are management concerns. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, cover crops, a mulch of crop residue, grassed waterways, and a cropping sequence that includes grasses and legumes reduce the hazard of erosion. Diversions are needed in some areas to intercept runoff from adjacent slopes.

These soils are moderately well suited to pasture. If the pasture is overgrazed or the soils are plowed during seedbed preparation, the hazard of erosion is very severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

Many areas are used as woodland. These soils are well suited to trees. Laying out skid trails and logging roads on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also reduce the hazard of erosion. Mowing and spraying equipment can be used to control plant competition in most areas, but equipment use is limited in areas where slopes are somewhat uneven or drainageways are deep. Planting seedlings that have been transplanted once reduces the seedling mortality rate in areas of the Homewood soil on south-facing slopes. Removing vines and the less desirable trees and shrubs helps to control plant competition. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and have more moisture available for plant growth because they are less exposed to the prevailing wind and the sun.

These soils are poorly suited to buildings. The moderately steep slope of both soils and the seasonal wetness of the Homewood soil are severe limitations. The buildings should be designed so that they conform to the natural slope of the land. Minor landscaping is needed in most areas. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

These soils are poorly suited to septic tank absorption fields. The slope of both soils and the seasonal wetness and slow permeability of the Homewood soil are severe limitations. Installing the distribution lines across the slope helps to prevent seepage of effluent to the surface. The slow permeability can be overcome by alternating the distribution of effluent into two absorption fields and by widening the bottom of the trench in the absorption fields. Installing interceptor drains upslope from the absorption field reduces the seasonal wetness of the Homewood soil.

Low strength, slope, and frost action are limitations on sites for driveways and for local roads and streets. The slope can be overcome by building on the contour. Designing the driveways, roads, and streets so that water does not collect and flow in unpaved areas helps to control erosion. The damage caused by frost action and low strength can be minimized by providing suitable base material and by installing a drainage system. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The land capability classification is IVe. The woodland ordination symbol for the Homewood soil is 1r on north aspects, 2r on south aspects, and for the Westmoreland soil is 2r on north aspects, 3r on south aspects.

HaE2—Homewood-Westmoreland silt loams, 25 to 40 percent slopes, eroded. These deep, steep soils are on hillsides. They are mainly on side slopes along small drainageways or on slope breaks to the uplands. The Homewood soil is moderately well drained and well drained, and the Westmoreland soil is well drained. Erosion has removed part of the original surface layer of both soils. The remaining surface layer is a mixture of the original surface layer and subsoil material. Slopes are commonly uniform but are irregular along drainageways. Most areas are 10 to 30 acres in size.

Most areas of this map unit are about 45 percent Homewood soil and 35 percent Westmoreland soil. The Westmoreland soil, however, is dominant in some areas. The Homewood soil is commonly on the lower slopes in coves and in areas deeply dissected by drainageways. In most areas it has a few quartzite, chert, flint, and rounded sandstone fragments on the surface. The Westmoreland soil is on the upper slopes. It has small sandstone fragments on the surface. The two soils occur as areas so narrow or so intricately mixed that mapping them separately is not practical.

Typically, the Homewood soil has a dark yellowish brown, friable silt loam surface layer about 6 inches thick. The subsoil is about 59 inches thick. It is mottled below a depth of about 30 inches. The upper part is brown and yellowish brown, friable silt loam and loam; the next part is a fragipan of yellowish brown, very firm, dense clay loam; and the lower part is yellowish brown, firm clay loam. The substratum to a depth of about 80 inches is yellowish brown, mottled, firm clay loam and loam. In a few places lacustrine sediments are in the substratum.

Typically, the Westmoreland soil has a brown, friable silt loam surface layer about 5 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown and brown, friable silt loam, and the lower part is brown, firm channery and very channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Hard, olive brown siltstone bedrock is at a depth of about 43 inches. In places the subsoil has a few glacial till pebbles.

Included with these soils in mapping are narrow bands of Guernsey soils. These included soils have more clay in the subsoil than the Homewood and Westmoreland soils. They are commonly below seepy spots. They make up about 20 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. It is moderate in the Westmoreland soil. Runoff is very rapid on both soils. The Homewood soil has a seasonal high water table at a depth of 32 to 48 inches during extended wet periods. Available water capacity is low in the Homewood soil and low or moderate in the Westmoreland soil. The potential for frost action is moderate in both soils. Unless lime has been applied, the subsoil of the Homewood soil is very strongly acid or strongly acid. The subsoil of the Westmoreland soil is medium acid to very strongly acid.

Some areas are pastured. These soils generally are unsuited to cultivated crops and are poorly suited to long-term hay and pasture. The steep slope severely limits the use of most kinds of equipment. Areas where the slopes are smooth are better suited to pasture and hay than those where slopes are uneven or dissected. If the soils are cultivated during seedbed preparation or the pasture is overgrazed, erosion is a very severe hazard. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Maintaining a stand of deep-rooted legumes is difficult in many areas. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Most areas are wooded. These soils are well suited to trees and to habitat for woodland wildlife. Laying out skid trails and logging roads on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also reduce the hazard of erosion. The steep slope limits the use of planting, spraying, and mowing equipment. Planting seedlings that have been transplanted once reduces the seedling mortality rate in areas of the Homewood soil on south-facing slopes. Removing vines and the less desirable trees and shrubs helps to control plant competition. Coves and north- and east-facing slopes are the best sites for woodland. These sites have cooler temperatures and have more moisture available for plant growth because they are less exposed to the prevailing wind and the sun.

These soils generally are unsuited to buildings and septic tank absorption fields because of the steep slope. The Homewood soil is also limited by seasonal wetness and slow permeability. Because of the erosion hazard, trails in recreation areas should be constructed on the contour if possible. Also, steps should be constructed where needed.

The land capability classification is VIe. The woodland ordination symbol for the Homewood soil is 1r on north aspects, 2r on south aspects, and for the Westmoreland soil is 2r on north aspects, 3r on south aspects.

Km—Killbuck silt loam, frequently flooded. This deep, nearly level, poorly drained soil is on flood plains. It makes up the entire flood plain or is in long, narrow areas. Some areas are near the stream channel. Others are adjacent to the slope breaks to low terraces or to uplands. Abandoned stream channels and small drainage ditches are in some areas. Slope is 0 to 2 percent. Most areas are 2 to 50 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 7 inches thick. The next layer is dark grayish brown, mottled, friable silt loam about 12 inches thick. Below this is a buried surface layer of very dark gray, mottled, firm silty clay loam about 12 inches thick. The buried subsoil is gray, mottled, firm silty clay loam about 15 inches thick. The substratum to a depth of about 80 inches is gray, friable loam. In places the buried soil is within a depth of 15 inches.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Newark soils in the slightly higher landscape positions. Also included are narrow strips of the well drained Nolin soils near stream channels in some areas. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Killbuck soil. Runoff is very slow. A seasonal high water table is near the surface for long periods. The buried soil is saturated most of the year. Available water capacity is high. The shrink-swell potential is moderate in the buried soil. The potential for frost action is high. The root zone is medium acid to mildly alkaline.

Most areas are used as cropland. This soil is moderately well suited to corn and soybeans. Drained areas are better suited to corn, soybeans, and legume-grass mixtures that can withstand wetness than to small grain and deep-rooted perennial crops. Planting is delayed in most years because of the flooding and the wetness. Logs, branches, and other debris commonly are scattered over the surface after floods. In areas that are dissected by the meandering stream channels, the use of large farm equipment is limited. Sediment deposited by floodwater damages hay crops. Reducing wetness, controlling weeds, and maintaining tilth and the organic matter content are management concerns. Diversions and subsurface drains are effective in intercepting water from adjacent slopes in many places. Applying a system of conservation tillage that leaves crop residue on the surface and incorporating crop residue into the plow layer help to maintain tilth and the organic matter content. Tilling within the proper range of moisture content helps to prevent excessive surface compaction.

Some areas are pastured. Undrained areas are better suited to pasture than to cropland. This soil is suited to Kentucky bluegrass, tall fescue, ladino clover, alsike clover, and reed canarygrass. Proper stocking rates, rotation grazing, weed control, and restricted grazing in winter and during other wet periods help to keep the pasture in good condition.

Only a small acreage is wooded. This soil is moderately well suited to trees. The wetness and the flooding limit the use of equipment. The trees can be logged during the drier parts of the year or when the soil is frozen. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Removing vines and the less desirable trees and shrubs helps to control plant competition. Harvesting procedures that do not leave the trees widely spaced or isolated reduce the windthrow hazard.

This soil generally is unsuited to buildings and septic tank absorption fields because of the wetness, the moderately slow permeability, and the frequent flooding. Undrained areas are suited to habitat for wetland wildlife.

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

LaB—Lakin loamy sand, 1 to 8 percent slopes. This deep, excessively drained, gently sloping soil is on terraces. Slopes generally are uniform or slightly convex but are irregular in dissected areas in small drainageways. Areas commonly are oblong and are parallel to the streams. Most range from 3 to 80 acres in size.

Typically, the surface layer is very dark grayish brown, very friable loamy sand about 8 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 18 inches thick. The subsoil is about 34 inches thick. It is yellowish brown, very friable loamy sand that has bands of brown, very friable sandy loam. The substratum to a depth of about 80 inches is brown, loose loamy sand. In a few places the subsoil has a slightly higher content of clay.

Included with this soil in mapping are narrow areas of soils in drainageways. These soils have a loam or silt loam surface layer and a seasonal high water table in the subsoil. They make up about 10 percent of most areas.

Runoff is slow on the Lakin soil. Permeability is rapid. Available water capacity is low. Unless the soil is limed, the subsoil is typically medium acid or strongly acid.

Most areas are used as cropland. The main crops are corn and grass-legume hay. This soil is moderately well suited to cropland. Droughtiness and erosion are the main management concerns. Soil blowing is a moderate hazard. Because the available water capacity is limited, the soil is better suited to crops that mature early in summer than to late-maturing crops. Moisture stress is common in summer. The soil is well suited to no-till planting and to irrigation. Erosion can be controlled and moisture can be conserved by applying no-till, minimum tillage, or contour tillage; by planting winter cover crops; and by including small grain and forage crops in the cropping sequence. The surface layer can be worked throughout a wide range of moisture content. Leaching of plant nutrients, especially nitrogen, is rapid. Plants on the soil generally respond better to smaller, more frequent applications of fertilizer and lime than to one large application. Diversions can intercept water from upland slopes in many areas.

If irrigated, this soil is well suited to orchard and truck crops. These crops can be damaged by frost, however, because of poor air drainage.

This soil is moderately well suited to pasture. It is well suited to grazing early in spring. Because of droughtiness in summer, pastures should be seeded early in spring or late in summer. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, and mowing to control weeds help to maintain a good stand of the key forage species.

Some areas are wooded. This soil is poorly suited to trees. Planting seedlings that have been transplanted once or selecting suitable species reduces the seedling mortality rate.

A few areas are under urban development. This soil is well suited to buildings, septic tank absorption fields, and local roads and streets. Sloughing is a hazard in shallow excavations. The soil readily absorbs but does not adequately filter the effluent from septic tanks. As a result, the effluent can pollute ground water supplies. Installing the absorption field in suitable fill material improves the filtering capacity. Droughtiness is a hazard if lawns are established during the drier part of the year. Newly seeded lawns should be mulched and watered.

The land capability classification is IIIs. The woodland ordination symbol is 4s.

Ln—Linwood muck. This deep, nearly level, very poorly drained soil is in low lying bogs on outwash plains. It is subject to ponding. Slope is 0 to 2 percent. Most areas are circular or irregularly shaped. They range from 5 to 100 acres in size.

Typically, the surface layer is black, very friable muck about 7 inches thick. The next layer is black and very dark grayish brown, very friable muck about 31 inches thick. The substratum to a depth of about 80 inches is gray, friable silt loam. In a few places the depth to the substratum is more than 50 inches.

Permeability is moderately slow to moderately rapid in the organic layers and moderate in the loamy material. Available water capacity and the organic matter content are very high. Tilth is good. Unless drained, the soil has a seasonal high water table near or above the surface for long periods. The potential for frost action is high. The subsoil ranges from medium acid to mildly alkaline.

Drained areas generally are used for corn or soybeans. They are moderately well suited to these crops. The wetness is the main limitation. Surface drains are used in some areas to remove ponded water. Subsurface drains are also used, but outlets are difficult to establish in places. Pump drainage is needed in some areas. Ditchbanks are unstable. As a result of the oxidation of organic material, subsidence or shrinkage can occur after the soil is drained, causing displacement of subsurface drains. During dry periods, soil blowing and the risk of fire are the major management concerns. Controlled drainage in areas where the water table can be raised or lowered reduces the susceptibility to subsidence, burning, and soil blowing. Soil blowing can be controlled by irrigating, planting windbreaks, and planting cover crops.

This soil can be easily tilled. Compaction rather than loosening may be needed to provide a good seedbed. Because of the very high organic matter content, the soil readily absorbs water, nutrients, and pesticides. Applications of the proper amount of herbicide help to control weeds. When wet, the soil cannot support narrow-wheeled equipment. Some areas can be subirrigated through tile lines. Plants can be damaged by frost because of the low position on the landscape.

A few drained areas are pastured, but this soil is poorly suited to pasture. It is very soft during wet periods. As a result, grazing can cause extensive damage to plants. Water-tolerant grasses, such as reed canarygrass, grow well even during dry periods.

Undrained areas support small trees, shrubs, cattails, reeds, and sedges. In undrained areas this soil is well suited to habitat for wetland wildlife. It is poorly suited to trees. Establishing seedlings is difficult. Selecting suitable species and planting seedlings that have been transplanted once reduce the seedling mortality rate. The wetness seriously limits the use of logging equipment. The trees can be logged when the soil is frozen to a sufficient depth. Frequent, light thinning and harvesting methods that do not leave the trees widely spaced or isolated reduce the windthrow hazard.

Removing vines and the less desirable trees and shrubs help to control plant competition.

Because of the ponding, low strength, and the moderately slow permeability, this soil generally is unsuited to buildings and septic tank absorption fields.

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

Lu—Luray silt loam. This deep, nearly level, very poorly drained soil is on smooth slopes in slight depressions on terraces along streams, in old glacial lake basins, and on outwash plains. It is subject to ponding. Slope is 0 to 2 percent. Most areas range from 2 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is black, friable silt loam about 4 inches thick. The subsoil is dark gray, gray, and yellowish brown, mottled, friable and firm silt loam and silty clay loam about 29 inches thick. The substratum to a depth of about 80 inches is grayish brown, mottled, friable silt loam.

Included with this soil in mapping are small areas of the poorly drained Killbuck soils on flood plains. These soils have a surface layer that is lighter colored than that of the Luray soil. Also included are some narrow strips on low stream terraces that are subject to rare flooding and narrow areas of the somewhat poorly drained Fitchville soils near slope breaks to flood plains. Included soils make up 10 to 20 percent of most areas.

Permeability is moderately slow in the Luray soil. Runoff is very slow or ponded. A seasonal high water table is near or above the surface. It reduces the depth of the root zone. Available water capacity is high. The shrink-swell potential is moderate in the subsoil. The potential for frost action is high. The subsoil is medium acid to neutral.

Most areas are drained and are used as cropland. A few are pastured or wooded. If drained, this soil is well suited to row crops, hay, and pasture. In drained areas it can be used for intensively grown corn and soybeans. Small grain generally is damaged by the ponding in winter and spring. The ponding and the seasonal wetness are the main management concerns. Subsurface drains and open ditches generally help to lower the seasonal high water table and remove excess surface water. Careful management is needed to maintain tilth and the organic matter content because the soil becomes compact and cloddy if tilled when wet. Incorporating crop residue into the plow layer and planting cover crops improve tilth and increase the rate of water infiltration.

A few areas are pastured. This soil is well suited to pasture but is poorly suited to grazing early in spring. It is suited to Kentucky bluegrass, tall fescue, ladino clover, alsike clover, birdsfoot trefoil, and reed canarygrass. A drainage system improves the pasture, helps to control competing reeds and sedges, and extends the grazing season. Proper stocking rates, pasture rotation, mowing to control weeds, and restricted use during wet periods help keep the pasture in good condition.

A few undrained areas are wooded, mainly with second-growth swamp forest species. This soil is well suited to trees that can withstand periods of prolonged wetness. The wetness limits the use of planting and harvesting equipment during winter and spring, but trees can be logged during the drier periods or when the soil is frozen. Removing vines and the less desirable trees and shrubs helps to control plant competition. Frequent, light thinning and harvesting procedures that do not leave the trees widely spaced or isolated increase the vigor of the stand and reduce the windthrow hazard. Planting seedlings that have been transplanted once reduces the seedling mortality rate.

This soil generally is unsuited to buildings and septic tank absorption fields. The ponding and the moderately slow permeability are the main limitations. Also, flooding is a hazard in some of the lower included areas. Low strength, ponding, and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by installing a drainage system and by providing suitable base material.

The land capability classification is IIw. The woodland ordination symbol is 2w.

Mc—Melvin silt loam, ponded. This deep, nearly level, poorly drained soil is on flood plains. Some areas are dissected by stream meanders and small open drainage ditches. The soil is flooded several times a year and remains ponded for several months after the floodwater recedes. Slope is 0 to 2 percent. Most areas are long and narrow. They range from 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 4 inches thick. The subsurface layer is dark grayish brown, mottled, friable silt loam about 8 inches thick. The substratum to a depth of about 80 inches is gray and dark gray, friable silt loam. It is mottled within a depth of 54 inches.

Included with this soil in mapping are narrow strips of the somewhat poorly drained Newark soils adjacent to stream channels. These soils make up 10 to 20 percent of most areas. Also included are areas that have 2 to 4 feet of ultra acid, coarse textured recent sediment on the surface. These areas are generally downstream from strip mines.

Permeability is moderate in the Melvin soil. A seasonal high water table is near or above the surface. It reduces the depth of the root zone. Available water capacity and the potential for frost action are high. The root zone is medium acid to neutral.

This soil generally is unsuited to crops and pasture because of the ponding and the frequent flooding. A few areas could be drained, but draining most areas is not practical because sediment in the stream channels blocks drainage outlets. Drainageways and channels that have been cleaned or deepened are subject to siltation.

Most areas support trees, shrubs, sedges, reeds, and cattails. They are used as wildlife habitat. This soil is well suited to habitat for wetland wildlife. It is poorly suited to trees. Wooded areas support mostly willow, elm, boxelder, and red maple. The ponding and the flooding severely limit the selection of suitable trees and the use of planting and logging equipment. Trees can be logged during the drier parts of some years or when the soil is frozen. Selecting suitable species or planting seedlings that have been transplanted once reduces the seedling mortality rate. Removing vines and the less desirable trees and shrubs help to control plant competition. Frequent, light thinning and harvesting methods that do not leave the trees widely spaced or isolated reduce the windthrow hazard.

This soil generally is unsuited to buildings and septic tank absorption fields because of the frequent flooding and the ponding.

The land capability classification is Vw. The woodland ordination symbol is 4w.

MeB—Mentor silt loam, gravelly substratum, 1 to 8 percent slopes. This gently sloping, deep, well drained soil is on terraces along streams. Most of the terraces are about 5 to 40 feet above the flood plains. Slopes are typically short and are smooth or convex. They are irregular near small drainageways. Most areas range from 10 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown and brown, friable silt loam and silty clay loam, and the lower part is strong brown, friable gravelly sandy clay loam. The substratum to a depth of about 80 inches is dark brown, friable gravelly sandy loam. In some areas the depth to the gravelly substratum is 24 to 40 inches.

Included with this soil in mapping are narrow strips of the somewhat poorly drained Fitchville soils in slight depressions. These soils make up about 5 percent of most areas.

Permeability is moderate in the Mentor soil. Available water capacity is high. Runoff is medium in cultivated areas. The potential for frost action is high. Unless the soil is limed, the subsoil is medium acid to very strongly acid in the upper part and strongly acid to slightly acid in the lower part.

Most areas are used as cropland. Several farmsteads are in areas of this soil. The soil is well suited to corn, soybeans, small grain, grasses and legumes for hay, and specialty crops. Because of poor air drainage, however, crops can be damaged by frost. The soil can be tilled early in spring. Cultivated crops can be grown year after year if erosion is controlled. The hazard of erosion is moderate if the soil is cultivated or if the protective plant cover is removed. This hazard can be reduced by a system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, cover crops, and contour tillage. The longer slopes are suited to contour stripcropping. The surface layer crusts after hard rains. Tilling within the proper range of moisture content helps to prevent excessive compaction and crusting. The soil is suited to irrigation if erosion is controlled.

This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a very small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

This soil is well suited to buildings and septic tank absorption fields. Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material.

The land capability classification is IIe. The woodland ordination symbol is 1a.

MeC—Mentor silt loam, gravelly substratum, 8 to 15 percent slopes. This strongly sloping, deep, well drained soil is on terraces along streams. It generally is in well defined, benchlike areas between slope breaks to the uplands and the lower lying flood plains. Most areas are dissected by one or more small drainageways. They have steeper slopes near the drainageways. Slopes are typically smooth to convex. Most areas range from 3 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown and brown, friable silt loam and silty clay loam, and the lower part is strong brown, friable gravelly sandy clay loam. The substratum to a depth of about 80 inches is dark brown, friable gravelly sandy loam. In some areas the depth to the gravelly substratum is 24 to 40 inches.

Included with this soil in mapping are spots of severely eroded Mentor soils that have a yellowish brown surface layer. These soils are near slope breaks. They crust and puddle easily and are difficult to protect from further erosion. They make up about 15 percent of most areas.

Permeability is moderate in this Mentor soil. Available water capacity is high. Runoff is rapid in cultivated areas. The potential for frost action is high. Unless the soil is limed, the subsoil is medium acid to very strongly acid in the upper part and strongly acid to slightly acid in the lower part.

Most areas are used as cropland. This soil is moderately well suited to corn and small grain and is well suited to grasses and legumes for hay. Because of the high potential for frost action, maintaining stands of deep-rooted legumes is difficult. Smooth, even slopes are better suited to cultivated crops than dissected or uneven slopes. If the soil is cultivated or if the protective plant cover is removed, the hazard of erosion is severe. Controlling erosion and maintaining tilth and the organic matter content are management concerns. The surface layer crusts after hard rains. If conservation measures are applied, a common rotation includes a cultivated or small grain crop once every 2 years. A system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, contour stripcropping, cover crops, grassed waterways, and a mulch of crop residue reduce the hazard of erosion. In some areas diversions are needed. Tilling within the proper range of moisture content helps to prevent excessive compaction and crusting.

This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

This soil is moderately well suited to buildings and septic tank absorption fields. The slope is the main limitation. Designing buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent excessive seepage of effluent to the surface. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

Ne—Newark silt loam, frequently flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. It makes up the entire flood plain or is in long, narrow areas in slight depressions adjacent to slope breaks to the uplands, to stream terraces, or to alluvial fans. Abandoned stream channels and small drainage ditches are in some areas. Slope is 0 to 2 percent. Most areas range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is grayish brown and brown, mottled, friable silt loam about 34 inches thick. The substratum to a depth of about 80 inches is gray, mottled, friable silt loam. In a few places the subsoil has layers of loam or sandy loam.

Included with this soil in mapping are small areas of the poorly drained Melvin soils in depressions, in abandoned stream channels, and below seepy spots in the higher lying areas on uplands. Also included are narrow strips of the well drained Nolin soils adjacent to stream channels. Included soils make up less than 15 percent of most areas.

Permeability is moderate in the Newark soil. Runoff is slow. Available water capacity is high. A seasonal high water table is at a depth of 6 to 18 inches during extended wet periods. The soil layers below a depth of about 3 feet are saturated for long periods. During these periods poor aeration in the subsoil limits the depth of the root zone. The potential for frost action is high. Unless the soil is limed, the subsoil is medium acid to neutral.

A few areas are drained and are used as cropland. This soil is poorly suited to most crops. It is better suited to corn and legume-grass mixtures that can withstand some wetness than to small grain and deep-rooted perennial crops. Small grain and hay yields are reduced in some years by siltation and flooding. Planting is delayed in some years by the wetness and the flooding. Logs, branches, and other debris commonly are scattered over the surface after the floodwater recedes. Subsurface drainage is impractical in some areas because of inadequate outlets. In many areas surface drains help to remove floodwater. Reducing wetness, maintaining tilth and the organic matter content, and controlling weeds are management concerns. In many places diversions or subsurface drains reduce wetness by intercepting water from the adjacent slopes. Applying a system of conservation tillage that leaves crop residue on the surface and incorporating crop residue into the plow layer help to maintain tilth. Tilling within the proper range of moisture content helps to prevent excessive surface compaction.

Many areas are pastured. This soil is moderately well suited to pasture but is poorly suited to grazing early in spring. The suitable forage species include Kentucky bluegrass, tall fescue, reed canarygrass, ladino clover, alsike clover, and birdsfoot trefoil. Proper stocking rates, pasture rotation, mowing for weed control, timely applications of fertilizer, and restricted use during winter and during other wet periods help to maintain a good stand of the key forage species.

Most areas are wooded. This soil is well suited to trees. Removing vines and the less desirable trees and shrubs helps to control plant competition.

This soil generally is unsuited to buildings and septic tank absorption fields because of the seasonal wetness and the frequent flooding. Undrained areas are used as habitat for wetland wildlife.

The land capability classification is IIIw. The woodland ordination symbol is 1a.

No—Nolin silt loam, occasionally flooded. This nearly level, deep, well drained soil is on the higher parts of flood plains along the major streams. Slope is 0 to 3 percent. Most areas range from 20 to 300 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is brown and dark yellowish brown, friable silt loam about 49 inches thick. It is mottled in the lower part. The substratum to a depth of about 80 inches is brown and dark grayish brown, mottled, friable silt loam. In places the subsoil has thin layers of loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Newark soils. These soils are commonly in slight depressions in abandoned stream channels and in narrow strips adjacent to slope breaks to terraces and uplands. Also included are small areas of soils that have a channery loam surface layer. These soils are on alluvial fans where very small drainageways enter wider valleys. The small, flat stones in the channery areas reduce the available water capacity and can interfere with tillage. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Nolin soil. Runoff is slow. Available water capacity is very high. A seasonal high water table is at a depth of 36 to 72 inches during extended wet periods. The potential for frost action is high. Unless the soil is limed, the subsoil is neutral to medium acid.

Most areas are used as cropland. If good management is applied, this soil is well suited to row crops grown year after year. It is well suited to corn and midseason specialty crops. Reducing the hazard of flooding, maintaining tilth and the organic matter content, and draining the wetter included soils are management concerns. The surface layer crusts after hard rains. Flooding and siltation reduce yields of small grain and hay. Planting is delayed in some years because of the flooding. Water stands on the included somewhat poorly drained Newark soils for short periods following floods. Flooding damages legume stands and reduces crop yields. Applying a system of conservation tillage that leaves crop residue on the surface and incorporating crop residue into the plow layer help to maintain tilth and the organic matter content. Tilling within the proper range of moisture content helps to prevent excessive surface compaction and crusting and improves tilth. The control of Johnsongrass and other weeds is a problem in grain fields where weed seeds have been deposited by the floodwater. The soil is well suited to sprinkler irrigation.

The narrow flood plains are commonly pastured (fig. 4). This soil is well suited to pasture. Flooding is a hazard to livestock. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of fertilizer help to maintain a good stand of the key forage species. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Only a small acreage is wooded. This soil is well suited to trees. Removing vines and the less desirable trees and shrubs helps to control plant competition.

Because of the hazard of flooding, this soil generally is unsuited to buildings and septic tank absorption fields. It is suited to picnic areas, golf fairways, and hiking trails.

The land capability classification is IIw. The woodland ordination symbol is 1a.

OcA—Ockley loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on broad flats on terraces. Most areas are blocky. They range from 3 to 200 acres in size.

Typically, the surface layer is brown, friable loam about 9 inches thick. The subsoil is about 40 inches thick. The upper part is brown, friable loam and clay loam, and the lower part is brown and dark yellowish brown, friable gravelly clay loam and very friable very gravelly sandy loam. The substratum to a depth of about 80 inches is yellowish brown, calcareous, loose very gravelly loamy coarse sand. In some areas the substratum contains more silt and clay.

Included with this soil in mapping are intermingled small areas of soils that have a low available water capacity and are droughty in most years. These soils contain more gravel throughout than the Ockley soil. They make up 5 to 10 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Runoff is slow. Available water capacity is moderate. The surface layer can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential in the subsoil and the potential for frost action are moderate. In unlimed areas the subsoil is medium acid or strongly acid in the upper part and medium acid to neutral in the lower part.

Almost all areas are used as cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Crops can be seeded early because the soil warms and dries early in the spring. Row crops can be grown year after year if a high level of management is applied. The soil is well suited to irrigation. Applying a system of conservation tillage and incorporating crop residue into the plow layer help to maintain tilth and the organic matter content.

Figure 4.—A pastured area of Nolin silt loam, occasionally flooded. Homewood-Westmoreland silt loams, 15 to 25 percent slopes, eroded, is in the background.

This soil is well suited to pasture and to grazing early in spring. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage species.

Only a small acreage is used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to buildings and septic tank absorption fields. The moderate shrink-swell potential is a limitation on sites for buildings. Sloughing is a hazard in shallow excavations. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields too deep in the soil may result in the pollution of underground water supplies. Local roads and streets can be improved by replacing the surface layer and subsoil with suitable base material, which minimizes the damage caused by low strength and frost action. The soil is a probable source of sand and gravel.

The land capability classification is I. The woodland ordination symbol is 1a.

OcB—Ockley loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on low knolls and on the sides of terraces. Slopes are uniform or slightly convex. Areas are commonly round or oblong. They range from 2 to 20 acres in size.

Typically, the surface layer is brown, friable loam about 8 inches thick. The subsoil is about 40 inches thick. The upper part is brown, friable loam and clay loam, and the lower part is brown and dark yellowish brown, friable gravelly clay loam and very friable very gravelly sandy loam. The substratum to a depth of about 80 inches is yellowish brown, calcareous, loose very gravelly loamy coarse sand. In some areas the substratum contains more silt and clay.

Included with this soil in mapping are intermingled narrow areas of soils that have a low available water capacity and are droughty in most years. These soils contain more gravel throughout than the Ockley soil. They make up about 10 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Available water capacity is moderate. Runoff is medium in cultivated areas. The shrink-swell potential in the subsoil and the potential for frost action are moderate. In unlimed areas the subsoil is medium acid or strongly acid in the upper part and medium acid to neutral in the lower part.

This soil is used mainly as cropland. It is well suited to corn and small grain and to grasses and legumes for hay. Cultivated crops can be grown year after year if erosion is controlled. The soil warms and dries early in spring and is well suited to early season specialty crops. Because of poor air drainage, however, these crops can be damaged by frost. The soil is well suited to irrigation if erosion is controlled. A system of conservation tillage that leaves crop residue on the surface, incorporation of crop residue into the plow layer, a cropping sequence that includes grasses and legumes, contour tillage, cover crops, and contour stripcropping on the longer slopes reduce the erosion hazard.

This soil is well suited to pasture and to grazing early in spring. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage species.

Only a small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

This soil is well suited to buildings and septic tank absorption fields. The moderate shrink-swell potential is a limitation on sites for buildings. Sloughing is a hazard in shallow excavations. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields too deep in the soil may result in the pollution of underground water supplies. Local roads and streets can be improved by replacing the surface layer and subsoil with suitable base material, which minimizes the damage caused by low strength and frost action. The soil is a probable source of sand and gravel.

The land capability classification is IIe. The woodland ordination symbol is 1a.

OcC2—Ockley loam, 6 to 12 percent slopes, eroded. This sloping, deep, well drained soil is on terraces. Slopes are smooth or slightly convex. Most areas are oblong and are parallel to streams. Others are rounded knolls. Most range from 5 to 15 acres in size.

Typically, the surface layer is brown, friable loam about 6 inches thick. Erosion has removed part of the original surface layer. The remaining surface layer is a mixture of the original surface layer and subsoil material. The subsoil is about 40 inches thick. The upper part is brown, friable loam and clay loam, and the lower part is brown and dark yellowish brown, friable gravelly clay loam and very friable very gravelly sandy loam. The substratum to a depth of about 80 inches is yellowish brown, calcareous, loose very gravelly loamy coarse sand. In some areas the substratum contains more silt and clay.

Included with this soil in mapping are narrow strips of soils that have a low available water capacity and are droughty in most years. These soils contain more gravel throughout than the Ockley soil. They are on the upper part of slopes. They make up 15 to 20 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Available water capacity is moderate. Runoff is rapid in cultivated areas. The shrink-swell potential in the subsoil and the potential for frost action are moderate. In unlimed areas the subsoil is medium acid or strongly acid in the upper part and medium acid to neutral in the lower part.

Most areas are used as cropland. This soil is moderately well suited to corn, soybeans, small grain, and hay. Erosion is a severe hazard if the soil is cultivated. The soil dries and warms early in spring, allowing early planting. It is droughty during extended dry periods. If conservation measures are applied, a common rotation includes a row crop or small grain every other year. A system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, a mulch of crop residue, cover crops, and contour stripcropping reduce the hazard of erosion and increase the organic matter content.

This soil is well suited to pasture and to grazing early in spring. Pastures should be seeded early in spring or late in summer. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Because of leaching, plants generally respond better to smaller, more frequent applications of lime and fertilizer than to one large annual application. Proper stocking rates, pasture rotation, and mowing to control weeds help to maintain a good stand of the key forage species.

Only a small acreage is used as woodland. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition.

This soil is moderately well suited to buildings and septic tank absorption fields. The slope and the moderate shrink-swell potential are limitations. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Designing buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Sloughing is a hazard in shallow excavations. Installing the distribution lines in septic tank absorption fields too deep in the soil may result in the pollution of underground water supplies. Installing them across the slope helps to prevent excessive seepage of effluent to the surface. Reseeding and mulching help to control erosion during construction.

Low strength, frost action, and slope are limitations on sites for local roads and streets. The damage caused by low strength and frost action can be minimized by replacing the surface layer and subsoil with suitable base material. The roads and streets should be built on the contour. The soil is a probable source of sand and gravel.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

Pg—Peoga silt loam, rarely flooded. This deep, nearly level, poorly drained soil is on low, wide terraces along the major streams. It is commonly separated from the stream by a slightly lower flood plain, but the break to the flood plain is poorly defined. Slope is 0 to 2 percent. Most areas range from 30 to 300 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 10 inches thick. The subsurface layer is gray, friable silt loam about 9 inches thick. The subsoil is gray, mottled, firm silty clay loam about 29 inches thick. The substratum to a depth of about 80 inches is gray, mottled, firm, stratified silt loam and silty clay loam. In a few places the surface layer is 10 to 15 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Euclid soils on low rises and near slope breaks to hillsides and the higher terraces. These soils make up about 20 percent of most areas.

Permeability is slow in the Peoga soil. Available water capacity is high. A seasonal high water table is near the surface during extended wet periods. Runoff is very slow. The shrink-swell potential is moderate in the subsoil. The potential for frost action is high. In unlimed areas the subsoil is strongly acid or very strongly acid.

Some drained areas are used as cropland. If drained, this soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay. It is better suited to soybeans than to corn. Reducing wetness, preventing surface compaction, and maintaining tilth and the organic matter content are management concerns. The soil is subject to crusting after hard rains. The flooding and the wetness can damage stands of winter wheat and barley and often delay seeding of oats in spring. A surface and subsurface drainage system removes excess water and lowers the water table. In some areas diversions can intercept water from adjacent slopes. Applying minimum tillage, planting cover crops, incorporating crop residue into the plow layer, and including grasses and legumes in the cropping sequence improve tilth. Tilling within the proper range of moisture content helps to prevent excessive surface compaction and crusting.

Many areas are pastured (fig. 5). This soil is moderately well suited to pasture. It is poorly suited to grazing in early spring. Undrained areas are dominated by sedges and other water-tolerant native plants. Drained areas are suited to tall fescue, ladino clover, alsike clover, and birdsfoot trefoil. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to keep the pasture in good condition. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Many areas are wooded. This soil is well suited to trees. Logging, planting, and mowing are often delayed because of wetness. Trees can be logged during the drier periods or when the soil is frozen. Frequent, light thinning and harvesting increase the vigor of the stand and reduce the windthrow hazard. Removing vines and the less desirable trees and shrubs helps to control plant competition. Planting seedlings that have been transplanted once reduces the seedling mortality rate.

Because of the seasonal wetness, the slow permeability, and the rare flooding, this soil generally is unsuited to buildings and septic tank absorption fields. Low strength, wetness, and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by installing a drainage system and by providing suitable base material.

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

Pm—Pewamo silty clay loam. This deep, nearly level, poorly drained and very poorly drained soil is in shallow depressions and along small drainageways on till plains. It is subject to ponding in the lower part of the depressions because of the runoff from higher lying adjacent soils. Most areas are oval or irregularly shaped. They range from 5 to 10 acres in size. Slope is 0 to 2 percent.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 9 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsoil is dark gray, mottled, firm silty clay loam about 31 inches thick. The substratum to a depth of about 80 inches is dark gray, mottled, firm silty clay loam.

Figure 5.—A pastured area of Peoga silt loam, rarely flooded.

Included with this soil in mapping are small areas of the somewhat poorly drained Bennington soils on slight rises and near slope breaks. These soils make up about 10 percent of most areas.

Permeability is moderately slow in the Pewamo soil. Available water capacity is high. Runoff is very slow or ponded. A seasonal high water table is near or above the surface during extended wet periods. Saturation and poor aeration limit the depth of the root zone. The organic matter content is high. The shrink-swell potential is moderate. The potential for frost action is high. The subsoil is slightly acid or neutral.

Most areas are drained and are used as cropland. Drained areas are well suited to corn, soybeans, and hay. Row crops can be grown year after year if good management is applied. Small grain yields are reduced in most years. Wetness is the main limitation. Subsurface drains generally help to lower the seasonal high water table. Most of the areas used as cropland have been drained, but many of the drainage systems are inadequate. In some areas surface drains, waterways, and diversions are needed. Tilling within the proper range of moisture content helps to prevent excessive surface compaction. In most years the planting of corn and soybeans is delayed by wetness. Returning crop residue to the soil and planting cover crops improve fertility, minimize crusting, and increase the rate of water infiltration.

In drained areas this soil is well suited to pasture but is poorly suited to grazing in spring and during other wet periods. It is suited to Kentucky bluegrass, tall fescue, ladino clover, alsike clover, birdsfoot trefoil, and reed canarygrass. Proper stocking rates, mowing to control weeds, pasture rotation, and timely applications of lime and fertilizer help to keep the pasture in good condition.

Only a small acreage is wooded. This soil is well suited to trees. Selection of suitable species for planting reduces the seedling mortality rate. Frequent, light thinning and harvesting procedures that do not leave the trees widely spaced or isolated reduce the windthrow hazard. Removing vines and the less desirable trees and shrubs helps to control plant competition. The wetness limits the use of planting and harvesting equipment during winter and spring. Trees can be logged during the drier parts of the year or when the soil is frozen.

This soil generally is unsuited to buildings and septic tank absorption fields because of the ponding and the moderately slow permeability. Ponding, low strength, and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by installing a drainage system and by providing suitable base material.

The land capability classification is IIw. The woodland ordination symbol is 2w.

Uc—Udorthents-Pits complex. This map unit occurs mainly as areas that are surface mined for coal, limestone, industrial sand, and sandstone. The areas are about 70 percent Udorthents and 20 percent Pits. Udorthents generally are gently sloping to very steep soils and broken bedrock around the pits or near the edges of the unit. They also occur as elongated piles of soil material to be used for soil reconstruction after mining is completed. Reclaimed areas will be graded to the approximate original contour. The large stones and boulders will be buried, and the natural soil material will be replaced.

Typically, Udorthents are a mixture of rock fragments and partly weathered fine earth on ridges and cone-shaped piles 10 to 70 feet high. The rock fragments are mainly sandstone, siltstone, and shale in surface-mined areas and sandstone quarries and limestone in limestone quarries. The content of rock fragments, which include large stones and boulders, ranges from 40 to 80 percent. Reaction mainly is strongly acid to extremely acid, but some areas in limestone quarries are calcareous.

Pits are the nearly level areas between the piles of Udorthents in the last cut or between vertical highwalls and the Udorthents.

Included with this unit in mapping are moderately deep and deep, natural soils around the edge of the pits or in scattered small areas within the pits. These soils make up about 10 percent of most areas.

In areas where the Udorthents are bare, the erosion hazard is severe. A suitable plant cover is needed to control erosion. A number of abandoned limestone and sandstone quarries support brush and trees. These areas provide habitat for wildlife. The grasses and trees planted in reclaimed areas where sandstone formerly was quarried should be those that can withstand a very low available water capacity and the extremely acid conditions. The ones planted where limestone formerly was quarried should be those that can withstand a high content of lime. The available water capacity of the Udorthents is dominantly low or very low in the root zone, but it varies.

The suitability of this unit for buildings and sanitary facilities varies greatly. Onsite investigation is needed to determine the suitability. If reclamation measures are applied, many areas can be used as building sites after the soils have settled.

No land capability classification or woodland ordination symbol is assigned.

UpC—Upshur silty clay loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on ridgetops and on knolls on the wider ridgetops in the uplands. Areas are typically long and narrow on the ridgetops and are circular on the knolls. Slopes generally are smooth and convex, except for those near small drainageways. Most areas range from 3 to 20 acres in size.

Typically, the surface layer is reddish brown, firm silty clay loam about 7 inches thick. The subsoil is red and weak red, firm clay and silty clay about 35 inches thick. It is mottled in the lower few inches. The substratum is variegated weak red and olive yellow, firm silty clay loam. Light olive brown, soft shale bedrock is at a depth of about 75 inches. In some areas the upper part of the soil is more silty.

Included with this soil in mapping are areas of the moderately deep Gilpin soils on slight rises or in narrow strips near the edge of ridgetops. These soils are in areas that are generally less than half an acre in size. They make up about 10 percent of most areas.

Permeability is slow in the Upshur soil. Available water capacity is moderate. Runoff is rapid in cultivated areas. Tilth is fair. The soil dries slowly and cracks at the surface. The shrink-swell potential is high in the subsoil. The potential for frost action is moderate. Unless the soil is limed, the subsoil is very strongly acid to mildly alkaline.

A few areas are used as cropland. This soil is poorly suited to row crops and small grain and is moderately well suited to long-term hay. Row crops can be grown occasionally in rotation with small grain and hay if no-till management is applied. Controlling erosion, improving tilth, and increasing the organic matter content are management concerns. A system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, incorporation of crop residue into the plow layer, grassed waterways, and cover crops reduce the hazard of erosion and improve tilth. The silty clay loam surface layer is sticky when wet and hard when dry. Tilling within the proper range of moisture content helps to prevent excessive compaction and clodding.

Many areas are pastured. This soil is moderately well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer are needed to maintain a good stand of the key forage plants. The soil is poorly suited to grazing in winter and early in spring. Controlled grazing helps to prevent excessive compaction.

Many areas are used as woodland. This soil is moderately well suited to trees and is well suited to habitat for woodland wildlife. The use of equipment is limited because the silty clay loam surface layer is soft and slippery when wet. Laying out logging roads and skid trails on the contour facilitates the use of equipment. Mowing, spraying, and disking help to control plant competition. Removing vines and the less desirable trees and shrubs also reduces plant competition. Harvesting procedures that do not leave the trees widely spaced or isolated reduce the windthrow hazard. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate.

This soil is moderately well suited to buildings. The high shrink-swell potential, the slope, and hillside slippage are limitations. Removing as little vegetation as possible, mulching, or establishing a temporary plant cover reduces the hazard of erosion during construction. Designing walls that have pilasters, reinforcing walls and foundations, supporting walls with a large spread footing, and backfilling around foundations with material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Designing the buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Excessive cutting and filling can result in unstable site conditions and increase the hazard of hillside slippage. The unstable sites are difficult to revegetate. Installing a drainage system where water collects and disposing of the water through stable outlets reduce the hazard of hillside slippage.

Because of the slope and the slow permeability, this soil is poorly suited to septic tank absorption fields. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface. The slow permeability can be overcome by alternating the distribution of effluent into two absorption fields or by installing the absorption field in suitable fill material.

Low strength and the shrink-swell potential are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material. Building the roads and streets on the contour and seeding the road cuts help to control erosion.

The land capability classification is IVe. The woodland ordination symbol is 3c.

UpD—Upshur silty clay loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on ridgetops and on the upper part of hillsides. Slopes are mainly smooth and convex, except for those near small drainageways. A few areas are seepy. Most areas are long and narrow. They range from 5 to 20 acres in size.

Typically, the surface layer is reddish brown, firm silty clay loam about 6 inches thick. The subsoil is red and weak red, firm clay and silty clay about 35 inches thick. The substratum is variegated weak red and olive yellow, firm silty clay loam. Light olive brown, soft shale bedrock is at a depth of about 75 inches.

Included with this soil in mapping are small areas of the moderately deep Gilpin soils near slope breaks. Also included are severely eroded spots where the surface layer is clayey. These spots are on the upper part of slopes. Included soils make up about 20 percent of most areas.

Permeability is slow in the Upshur soil. Available water capacity is moderate. Runoff is very rapid in cultivated areas. Tilth is fair. The soil dries slowly and cracks at the surface. The shrink-swell potential is high in the subsoil, and the potential for frost action is moderate. Unless the soil is limed, the subsoil is very strongly acid to mildly alkaline.

About half of the acreage is used for pasture and hay. Because of the slope, the silty clay loam surface layer, and a very severe erosion hazard, this soil generally is unsuited to cultivated crops. It is moderately well suited to pasture. Even though the moderately steep slope limits the use of equipment, the smooth slopes can be used for perennial grasses and legumes for hay. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage species. The soil is poorly suited to grazing in winter and during other wet periods because of the susceptibility to compaction and the very severe erosion hazard.

About half of the acreage is wooded. This soil is moderately well suited to trees and is well suited to habitat for woodland wildlife. Mechanical tree planting and mowing, spraying, and disking are limited because of the slope and the silty clay loam surface layer. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Removing vines and the less desirable trees and shrubs helps to control plant competition. Coves and north- and east-facing slopes are the best woodland sites. These sites have more moisture available for growth and have cooler temperatures because they are less exposed to the prevailing wind and the sun. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Harvesting procedures that do not leave the trees widely spaced or isolated reduce the windthrow hazard.

This soil is poorly suited to buildings because of the slope, the high shrink-swell potential, and the susceptibility to hillside slippage. The ridgetops and the higher, more convex parts of slopes are the best sites for buildings. Concave areas, the lower parts of slopes, drainageways, and seepy areas should not be selected as building sites.

Buildings should be designed so that they conform to the natural slope of the land. Excessive cutting, filling, and land shaping increase the hazard of slippage. Cuts can expose the clayey subsoil, which is sticky when wet, hard when dry, and difficult to grade. Maintaining as much vegetation on the site as possible during construction and reseeding or mulching excavated areas help to control erosion. Water that runs off roofs and driveways and effluent that is purified by aeration sewage disposal systems should be disposed of in subsurface drains or natural waterways. Backfilling along foundations with material that has a low shrink-swell potential, designing walls that have pilasters, and reinforcing walls and foundations help to prevent the damage caused by shrinking and swelling.

Because of the slope, the slow permeability, and the hazard of hillside slippage, this soil generally is unsuited to septic tank absorption fields. A better suited site should be selected where possible. An aeration sewage disposal system is another alternative.

The slope, low strength, and the high shrink-swell potential are limitations on sites for local roads and streets. The damage caused by low strength and by shrinking and swelling can be minimized by providing suitable base material. Building the roads and streets across the slope reduces the gradient and helps to control erosion.

The land capability classification is VIe. The woodland ordination symbol is 3r on north aspects, 4r on south aspects.

WhB—Wellston silt loam, 1 to 8 percent slopes. This deep, gently sloping, well drained soil is on broad ridgetops and benches. Slopes are dominantly smooth or convex. Most areas range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 40 inches thick. The upper part is brown, friable silt loam, and the lower part is yellowish brown and strong brown, firm loam. The substratum is strong brown, mottled, friable loam. Hard sandstone bedrock is at a depth of about 70 inches.

Included with this soil in mapping are small areas of the moderately deep Dekalb soils near slope breaks. Also included are small areas of the moderately well drained Zanesville soils near the center of the wider ridgetops. Included soils make up about 10 to 20 percent of most areas.

Permeability is moderate in the Wellston soil. Available water capacity is high. Runoff is medium in cultivated areas. The shrink-swell potential is low. The potential for frost action is high. Unless the soil is limed, the subsoil is medium acid to very strongly acid.

Most of the acreage is cropland. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. The hazard of erosion is moderate in cultivated areas. Cultivated crops can be grown year after year if erosion is controlled. Because of the high potential for frost action, maintaining stands of deep-rooted legumes, such as alfalfa, is difficult in many areas. Measures that control erosion and maintain tilth and the organic matter content are the main management needs. Examples are conservation tillage, contour farming, stripcropping, cover crops, incorporation of crop residue into the plow layer, and a cropping sequence that includes grasses and legumes. Tilling within the proper range of moisture content helps to prevent excessive compaction and crusting.

Many areas are pastured. This soil is well suited to pasture. If the soil is plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

A few areas are wooded. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition. Removing vines and the less desirable trees and shrubs also help to control plant competition.

This soil is well suited to buildings and moderately well suited to septic tank absorption fields. Stable building sites generally are available. In most areas the bedrock at a depth of 40 to 72 inches hinders excavation. Installing septic tank absorption fields in suitable fill material elevates the field a sufficient distance above the bedrock and increases the absorption rate. Frost action is a limitation on sites for local roads and streets. The damage caused by this limitation can be minimized by providing suitable base material.

The land capability classification is IIe. The woodland ordination symbol is 2a.

WhC—Wellston silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is mainly on rounded ridgetops and in saddles between knolls. A few areas are on benches. Slopes are generally smooth, but they are irregular along a few shallow drainageways. Most areas range from 4 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 40 inches thick. The upper part is brown, friable silt loam, and the lower part is yellowish brown and strong brown, firm loam. The substratum is strong brown, friable loam. Hard sandstone bedrock is at a depth of about 70 inches.

Included with this soil in mapping are small areas of the moderately deep Dekalb soils near slope breaks. Also included are small areas of the moderately well drained Zanesville soils near the center of the wider ridgetops. Included soils make up about 20 to 30 percent of most areas.

Permeability is moderate in the Wellston soil. Available water capacity is high. Runoff is rapid in cultivated areas. The shrink-swell potential is low. The potential for frost action is high. Unless the soil is limed, the subsoil is medium acid to very strongly acid.

Most areas are used as cropland or pasture. This soil is moderately well suited to corn, soybeans, and small grain and is well suited to grasses and legumes for hay. If the soil is cultivated or the plant cover is removed, the hazard of erosion is severe. If conservation measures are applied, the soil can be used for cultivated crops or small grain every other year. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, diversions, grassed waterways, a cropping sequence that includes grasses and legumes, cover crops, and a mulch of crop residue reduce the hazard of erosion. Tilling within the proper range of moisture content helps to prevent excessive compaction. Because of the high potential for frost action, maintaining stands of deep-rooted legumes, such as alfalfa, is difficult in many areas.

This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

A few areas are wooded. This soil is well suited to trees. Mowing, spraying, and disking help to control plant competition. Removing vines and the less desirable trees and shrubs also helps to control plant competition.

This soil is moderately well suited to buildings and septic tank absorption fields. The slope, the bedrock at a depth of 40 to 72 inches, and the moderate permeability are limitations. The buildings should be designed so that they conform to the natural slope of the land. In most areas the bedrock hinders excavation. Maintaining as much vegetation on the site as possible during construction helps to control erosion. Constructing driveways across the slope helps to control erosion and reduces the gradient. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent excessive seepage of effluent to the surface. Installing the absorption field in suitable fill material elevates the field a sufficient distance above the bedrock and increases the absorption rate.

Frost action is a limitation on sites for local roads and streets. The damage caused by this limitation can be minimized by providing suitable base material. Trails in recreation areas should be protected against erosion and laid out on the contour if possible.

The land capability classification is IIIe. The woodland ordination symbol is 2a.

WkB—Westmore silt loam, 1 to 8 percent slopes. This deep, gently sloping, well drained soil is on ridgetops and, to a lesser extent, in benchlike areas. Slopes are typically smooth and uniform, but some benches are cut by drainageways. Most areas range from 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsurface layer is mixed yellowish brown and brown, friable silt loam about 3 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam, and the lower part is yellowish brown, strong brown, and brown, firm silty clay. The substratum is light brownish gray, firm channery silty clay loam. Hard, olive brown siltstone bedrock is at a depth of about 70 inches. In some areas the lower part of the soil contains less clay.

Included with this soil in mapping are small areas of the moderately well drained Guernsey soils near slope breaks and on slight rises that are eroded. These soils have more clay in the upper part of the subsoil than the Westmore soil. They make up about 20 percent of most areas.

Permeability is moderate in the upper part of the Westmore soil and moderately slow or slow in the lower part. Runoff is medium in cultivated areas. Available water capacity is moderate or high. The shrink-swell potential in the lower part of the subsoil and the potential for frost action are high. Unless the soil is limed, the subsoil is very strongly acid to medium acid.

This soil is used mainly as cropland. It is well suited to cultivated crops and small grain and to grasses and legumes for hay. If the soil is cultivated, the erosion hazard is moderate. Cultivated crops can be grown year after year if erosion is controlled and good management is applied. The surface layer crusts after hard rains. Preventing excessive crusting and maintaining tilth and the organic matter content are management concerns. A system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, incorporation of crop residue into the plow layer, contour farming, stripcropping, and grassed waterways reduce the hazard of erosion and help to maintain tilth and the organic matter content. The soil is well suited to no-till. Tilling within the proper range of moisture content helps to prevent excessive compaction.

Some areas are pastured. This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

Some areas are wooded. This soil is well suited to trees and to habitat for woodland wildlife. Mowing, spraying, and disking help to control plant competition.

Because of the high shrink-swell potential, this soil is only moderately well suited to buildings. Backfilling along foundations with material that has a low shrink-swell potential, designing walls that have pilasters, and reinforcing walls and foundations help to prevent the damage caused by shrinking and swelling. Cuts can expose the clayey lower part of the subsoil, which is sticky when wet, hard when dry, and difficult to grade and revegetate. The surface layer and the upper part of the subsoil are better suited to lawns and gardens than the lower part of the subsoil. During site preparation, these layers should be stockpiled separately and used to blanket the site during the final grading. Maintaining as much vegetation on the site as possible during construction and reseeding or mulching excavated areas help to control erosion.

Although limited by the moderately slow or slow permeability, this soil is moderately well suited to septic tank absorption fields. This limitation can be overcome by installing the distribution lines slightly closer to the surface, by alternating the distribution of effluent into two absorption fields, or by installing the absorption fields in suitable fill material.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material.

The land capability classification is IIe. The woodland ordination symbol is 2a.

WkC—Westmore silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on benches on hillsides, on rounded ridgetops, and on the upper part of slopes below ridgetops. Most areas are long and rather narrow. Slopes are mainly smooth, but in a few areas they are irregular along small drainageways. Areas range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 51 inches thick. The upper part is yellowish brown and brown, friable silt loam and firm silty clay loam, and the lower part is yellowish brown, strong brown, and brown, firm silty clay. The substratum is light brownish gray, firm channery silty clay loam. Hard, olive brown siltstone bedrock is at a depth of about 70 inches. In some areas the lower part of the subsoil contains less clay.

Included with this soil in mapping are small areas of the moderately well drained Guernsey soils near slope breaks. These soils have more clay in the upper part of the subsoil than the Westmore soil. They make up about 15 percent of most areas.

Permeability is moderate in the upper part of the Westmore soil and moderately slow or slow in the lower part. Runoff is rapid in cultivated areas. Available water capacity is moderate or high. The shrink-swell potential in the lower part of the subsoil and the potential for frost action are high. Unless the soil is limed, the subsoil is very strongly acid to medium acid.

Most areas are farmed. This soil is moderately well suited to cultivated crops and small grain and is well suited to grasses and legumes for hay. The erosion hazard is severe in cultivated areas. If conservation measures are applied, a common rotation includes a cultivated or small grain crop every other year. The surface layer crusts after hard rains. Preventing excessive crusting and maintaining tilth and the organic matter content are management concerns. Applying a system of conservation tillage that leaves crop residue on the surface, including grasses and legumes in the cropping sequence, contour stripcropping, establishing grassed waterways, planting cover crops, and returning crop residue to the soil help to prevent excessive erosion and crusting. The soil is well suited to no-till. Tilling within the proper range of moisture content helps to prevent excessive compaction.

Many areas are pastured. This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

Many areas are wooded. This soil is well suited to trees and to habitat for woodland wildlife. Mowing, spraying, and disking help to control plant competition.

Because of the slope and the high shrink-swell potential, this soil is only moderately well suited to buildings. The higher and more convex parts of slopes are the best sites for buildings. Drainageways and the lower lying or concave areas should not be selected as building sites. Designing the buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Constructing driveways across the slope and designing them so that water does not collect and flow in unpaved areas help to control erosion. Backfilling along foundations with material that has a low shrink-swell potential, designing walls that have pilasters, and reinforcing walls and foundations help to prevent the damage caused by shrinking and swelling.

Cuts can expose the clayey lower part of the subsoil, which is sticky when wet, hard when dry, and difficult to grade and revegetate. The surface layer and the upper part of the subsoil are better suited to lawns and gardens than the lower part of the subsoil. During site preparation, these layers should be stockpiled separately and used to blanket the site during the final grading. Maintaining as much vegetation on the site as possible during construction and reseeding or mulching excavated areas help to control erosion.

This soil is poorly suited to septic tank absorption fields because of the slope and the moderately slow or slow permeability. The restricted permeability can be overcome by installing the absorption field in suitable fill material, by installing the distribution lines slightly closer to the surface, or by alternating the distribution of effluent into two absorption fields. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material.

The land capability classification is IIIe. The woodland ordination symbol is 2a.

WmC—Westmoreland silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on rounded ridgetops and on knolls on wide ridgetops. Slopes are generally smooth, but they are irregular around shallow drainageways in some areas. Most areas range from 3 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable silt loam, and the lower part is brown, firm channery and very channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Hard, olive brown siltstone bedrock is at a depth of about 43 inches. In some areas the soil is moderately deep to bedrock.

Included with this soil in mapping are small areas of the moderately deep Dekalb soils on narrow ridge crests or near slope breaks. These soils have more sand and a higher content of coarse fragments in the subsoil than the Westmoreland soil. They make up about 10 to 20 percent of most areas.

Permeability is moderate in the Westmoreland soil. Available water capacity is low or moderate. Runoff is rapid in cultivated areas. The potential for frost action is moderate. Unless the soil is limed, the subsoil is medium acid to very strongly acid.

This soil is used mainly as cropland. It is moderately well suited to cultivated crops and small grain and is well suited to grasses and legumes for hay. If the soil is cultivated or the plant cover is removed, the hazard of erosion is severe. Applying no-till or other systems of conservation tillage that leave crop residue on the surface, contour stripcropping, including grasses and legumes in the cropping sequence, planting cover crops, returning crop residue to the soil, installing diversions, and establishing grassed waterways reduce the hazard of erosion. Tilling within the proper range of moisture content helps to prevent excessive compaction. Because of the acid subsoil and the moderate potential for frost action, maintaining deep-rooted legumes, such as alfalfa, is difficult in many areas.

Many areas are pastured. This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to keep the pasture in good condition. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

A few areas are wooded. This soil is moderately well suited to trees and is well suited to habitat for woodland wildlife. Mowing, spraying, and disking help to control plant competition. Removing vines and the less desirable trees and shrubs also helps to control plant competition.

This soil is moderately well suited to buildings and septic tank absorption fields. The slope, the depth to bedrock, and the moderate permeability are limitations. Designing buildings so that they conform to the natural slope of the land minimizes the need for cutting, filling, and land shaping. Constructing driveways across the slope helps to control erosion and reduces the gradient. The moderate permeability can be overcome by installing the absorption fields in suitable fill material or by widening the bottom of the trench in the absorption fields. The fill material also elevates the field a sufficient distance above the bedrock. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

Low strength, frost action, and slope are limitations on sites for local roads and streets. The damage caused by low strength and frost action can be minimized by providing suitable base material. Constructing the roads and streets across the slope helps to control erosion and reduces the gradient. Trails in recreational areas should be protected against erosion and laid out on the contour if possible.

The land capability classification is IIIe. The woodland ordination symbol is 3a.

WmD—Westmoreland silt loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is mainly in strips around hillsides. A few small areas are on ridgetops and on knolls on the ridgetops. Slopes are mainly smooth. Most areas range from 10 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable silt loam, and the lower part is brown, firm channery and very channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Hard, olive brown siltstone bedrock is at a depth of about 43 inches. In some areas the soil is eroded. In other areas it is moderately deep to bedrock.

Included with this soil in mapping are small areas of the moderately deep Dekalb soils on the crests of ridges and knolls or near slope breaks. These soils have more sand and a higher content of coarse fragments in the subsoil than the Westmoreland soil. They make up about 15 to 20 percent of most areas.

Permeability is moderate in the Westmoreland soil. Available water capacity is low or moderate. Runoff is very rapid in cultivated areas. The potential for frost action is moderate. Unless the soil is limed, the subsoil is medium acid to very strongly acid.

Some areas are used as cropland. This soil is poorly suited to cultivated crops and is moderately well suited to small grain and to grasses and legumes for hay. In a commonly used rotation, a cultivated or small grain crop is grown once every 4 to 6 years. In cultivated areas the hazard of erosion is very severe. Controlling erosion and maintaining the organic matter content are management concerns. The soil is well suited to no-till. No-till or other systems of conservation tillage that leave crop residue on the surface, incorporation of crop residue into the plow layer, a cropping sequence that includes grasses or legumes, contour stripcropping, cover crops, diversions, and grassed waterways reduce the hazard of erosion. Because of the acid subsoil and the moderate potential for frost action, maintaining deep-rooted legumes is difficult in many areas.

Many areas are pastured. This soil is moderately well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to keep the pasture in good condition. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Many areas are used as woodland. This soil is moderately well suited to trees and is well suited to habitat for woodland wildlife. Laying out skid trails and logging roads on the contour facilities the use of equipment and helps to control erosion. Water bars and a vegetative cover also reduce the hazard of erosion. The slope somewhat limits the use of equipment, but mowing and spraying equipment can be used to control weeds. Removing vines and the less desirable trees and shrubs helps to control plant competition. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and have more moisture available for plant growth because they are less exposed to the prevailing wind and the sun.

This soil is poorly suited to buildings and septic tank absorption fields. The moderately steep slope is a severe limitation. Designing buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. In most places siltstone or fine grained and medium grained sandstone bedrock interferes with excavation. Downslope seepage of effluent is likely. Installing the distribution lines in septic tank absorption fields across the slope or in the less sloping areas helps to prevent excessive seepage of the effluent to the surface. Widening the bottom of the trench in the absorption fields helps to overcome the restricted permeability. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

Slope, frost action, and low strength are limitations on sites for local roads and streets. Designing driveways, roads, and streets so that water does not collect and flow in unpaved areas helps to control erosion. The damage to roads and streets caused by frost action and low strength can be minimized by providing suitable base material. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The land capability classification is IVe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

WmE—Westmoreland silt loam, 25 to 40 percent slopes. This deep, well drained, steep soil is on hillsides. Slopes are generally smooth but are irregular along drainageways in some areas. Most areas range from 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 2 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 33 inches thick. The upper part is brown and yellowish brown, friable silt loam, and the lower part is brown, firm channery and very channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Hard, olive brown siltstone bedrock is at a depth of about 43 inches.

Included with this soil in mapping are small areas of the moderately deep Dekalb soils near slope breaks. These soils have more sand and a higher content of coarse fragments in the subsoil than the Westmoreland soil. They make up about 20 percent of most areas.

Permeability is moderate in the Westmoreland soil. Runoff is very rapid. Available water capacity is low or moderate. The potential for frost action is moderate. Unless the soil is limed, the subsoil is very strongly acid to medium acid.

A few areas are used for hay and improved pasture. Some are used as unimproved pasture. This soil generally is unsuited to cropland and poorly suited to pasture. The steep slope limits the use of equipment. If the pasture is overgrazed or the soil is plowed during seedbed preparation, erosion is a very severe hazard. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction. Maintaining stands of deep-rooted legumes is difficult in many areas because of the acid subsoil and the moderate potential for frost action.

Most areas are wooded. This soil is moderately well suited to trees and is well suited to habitat for woodland wildlife. The slope limits the use of equipment. Laying out skid trails and logging roads on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also reduce the hazard of erosion. Removing vines and the less desirable trees and shrubs helps to control plant competition. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and have more moisture available for plant growth because they are less exposed to the prevailing wind and the sun.

This soil generally is unsuited to buildings and septic tank absorption fields because of the steep slope. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The land capability classification is VIe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

WnE—Westmoreland loam, 20 to 40 percent slopes, very bouldery. This deep, well drained, moderately steep and steep soil is on hillsides. Slopes are generally smooth but are irregular near drainageways. Rectangular or blocky stones and boulders as much as 10 feet across are 10 to 120 feet apart in most areas. Sandstone bedrock crops out near the upper part of most slopes. Most areas range from 20 to 200 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 8 inches thick. The subsoil is yellowish brown, firm loam and clay loam about 27 inches thick. It is mottled below a depth of about 30 inches. The substratum is yellowish brown, firm very channery loam. Hard, fine grained sandstone bedrock is at a depth of about 50 inches.

Included with this soil in mapping are a few areas of soils that do not have boulders and have very few coarse fragments on the surface or within a depth of 4 feet. These soils are near the lower part of the hillsides. They make up about 10 percent of most areas.

Permeability is moderate in the Westmoreland soil. Runoff is very rapid. Available water capacity is low or moderate. The potential for frost action is moderate. Unless the soil is limed, the subsoil is very strongly acid to medium acid.

Some areas are used as unimproved pasture. This soil generally is unsuited to cropland. It can be used for pasture, but most management practices are difficult to apply because of the stones and boulders on the surface. Tilling during seedbed preparation and mowing to control weeds generally are impractical. In most areas, however, it is possible to broadcast lime and fertilizer and to apply herbicides.

Most areas are used as woodland and as habitat for woodland wildlife. This soil is moderately well suited to trees and is well suited to habitat for woodland wildlife. Because of the very bouldery surface layer, mechanical planting and weed control are very difficult. Laying out logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also reduce the hazard of erosion. Removing vines and the less desirable trees and shrubs helps to control plant competition. Coves and north- and east-facing slopes are the best woodland sites. These sites have more moisture available for plant growth and have cooler temperatures because they are less exposed to the prevailing wind and the sun.

Because of the boulders, the depth to bedrock, the moderate permeability, and the moderately steep and steep slope, this soil generally is unsuited to buildings and septic tank absorption fields. It has potential for hiking trails.

The land capability classification is VIIs. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

WsF—Westmoreland-Guernsey silt loams, 40 to 70 percent slopes. These deep, very steep soils are on hillsides. The well drained Westmoreland soil is on the smooth and slightly convex, steeper parts of the hillsides, and the moderately well drained Guernsey soil is commonly on benches and in slightly concave areas. Many of the benches are seepy. Slopes are uneven. In a few areas, sandstone bedrock crops out and hillside slips are common. Most areas are 50 to 500 acres in size. They are about 50 percent Westmoreland soil and 30 percent Guernsey soil. The two soils occur as areas so narrow or so intricately mixed that mapping them separately is not practical.

Typically, the Westmoreland soil has a surface layer of very dark grayish brown, very friable silt loam about 2 inches thick. The subsurface layer is dark yellowish brown, friable silt loam about 3 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown and brown, friable silt loam, and the lower part is brown, firm channery and very channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Hard, olive brown siltstone bedrock is at a depth of about 43 inches.

Typically, the Guernsey soil has a surface layer of very dark grayish brown, very friable silt loam about 3 inches thick. The subsurface layer is pale brown, friable silt loam about 11 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, mottled, friable silt loam, and the lower part is light olive brown and yellowish brown, mottled, firm silty clay loam. The substratum is dark yellowish brown, mottled, firm silty clay loam. Gray, calcareous shale bedrock is at a depth of about 62 inches. In a few areas the subsoil is redder. In some severely eroded areas, the surface layer is thinner and lighter colored.

Included with these soils in mapping are small areas of Dekalb and Westmore soils. The moderately deep Dekalb soils are near outcrops of massive sandstone bedrock. Westmore soils are on benches. They are more silty in the upper part than the Westmoreland and Guernsey soils. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. The Guernsey soil has a seasonal high water table at a depth of 24 to 42 inches. Runoff is very rapid on both soils. Available water capacity is low or moderate in the Westmoreland soil and moderate in the Guernsey soil. The shrink-swell potential is high in the Guernsey soil and low in the Westmoreland soil. The potential for frost action is moderate in the Westmoreland soil and high in the Guernsey soil. Unless lime has been applied, the subsoil of the Westmoreland soil is medium acid to very strongly acid. The Guernsey soil is medium acid to extremely acid in the upper part of the subsoil and strongly acid to moderately alkaline in the lower part.

Some areas have been cleared and used as unimproved pasture but have reverted to woodland. These soils generally are unsuited to cropland and pasture. The very steep, uneven slopes severely limit the use of equipment.

These soils are used mainly as woodland and as habitat for woodland wildlife. They are moderately well suited to trees and to habitat for woodland wildlife. The very steep slope severely limits the use of equipment. Laying out logging roads and skid trails on the benches facilitates the use of equipment and helps to control erosion. Water bars and a vegetative cover also reduce the erosion hazard. Planting seedlings that have been transplanted once reduces the seedling mortality rate in areas of the Guernsey soil on south-facing slopes. Removing vines and the less desirable trees and shrubs helps to control plant competition. Coves and north- and east-facing slopes are the best woodland sites. These sites have more moisture available for plant growth and have cooler temperatures because they are less exposed to the prevailing wind and the sun.

These soils generally are unsuited to buildings and septic tank absorption fields. The very steep slope of both soils and the risk of hillside slippage, seasonal wetness, high shrink-swell potential, and moderately slow or slow permeability of the Guernsey soil are severe limitations. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The land capability classification is VIIe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

WtC—Woodsfield silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on ridgetops and saddles and, to a lesser extent, in benchlike areas on hillsides. Slopes are typically smooth and uniform or are slightly convex. Most areas range from 3 to 15 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 8 inches thick. The subsoil is about 39 inches thick. It is mottled between depths of about 34 and 42 inches. The upper part is yellowish brown and brown, friable silt loam and silty clay loam, and the lower part is dark red, dark reddish brown, and reddish brown, firm clay. The substratum is grayish brown, firm silty clay loam. Soft, grayish brown, calcareous shale bedrock is at a depth of about 51 inches. In some areas the upper part of the soil has a higher content of clay.

Included with this soil in mapping are small areas where the slope is 2 to 8 percent. These inclusions make up about 10 percent of most areas.

Permeability is moderate in the upper part of the Woodsfield soil and moderately slow or slow in the lower part. Runoff is rapid. Available water capacity and the potential for frost action are moderate. The shrink-swell potential is high in the lower part of the subsoil. Unless the soil is limed, the subsoil is strongly acid or very strongly acid in the upper part and strongly acid to mildly alkaline in the lower part.

Some areas are used as cropland. This soil is moderately well suited to cultivated crops and small grain and is well suited to grasses and legumes for hay and pasture. In cultivated areas the erosion hazard is severe. If conservation measures are applied, a common rotation includes a cultivated or small grain crop every other year. The surface layer crusts after hard rains. Reducing the hazard of erosion and maintaining tilth and the organic matter content are management concerns. Applying a system of conservation tillage that leaves crop residue on the surface, including grasses and legumes in the cropping sequence, contour stripcropping, establishing grassed waterways, planting cover crops, and returning crop residue to the soil help to prevent excessive erosion and crusting. Tilling within the proper range of moisture content helps to prevent excessive compaction. The soil is well suited to no-till.

Many areas are pastured. This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. Controlled grazing in winter and during other wet periods helps to prevent excessive compaction.

A few areas are wooded. This soil is well suited to trees and to habitat for woodland wildlife. Mowing, spraying, and disking help to control plant compaction. Frequent, light thinning and harvesting procedures that do not leave the trees widely spaced or isolated increase the vigor of the stand and reduce the windthrow hazard.

This soil is only moderately well suited to buildings because of the slope and the high shrink-swell potential in the lower part of the subsoil. The ridgetops and the higher and more convex parts of slopes are the best sites for buildings. Drainageways and the lower lying or concave areas should not be selected as building sites. Designing the buildings so that they conform to the natural slope of the land minimizes cutting, filling, and land shaping. Backfilling along foundations with material that has a low shrink-swell potential, designing walls that have pilasters, and reinforcing walls and foundations help to prevent the damage caused by shrinking and swelling.

Cuts can expose the reddish, clayey lower part of the subsoil, which is sticky when wet, hard when dry, and difficult to grade and revegetate. The surface layer and the upper part of the subsoil are better suited to lawns and gardens than the lower part of the subsoil. During site preparation, these layers should be stockpiled separately and used to blanket the site during the final grading. Maintaining as much vegetation on the site as possible during construction and reseeding or mulching excavated areas help to control erosion. Constructing driveways across the slope and designing them so that water does not collect and flow in unpaved areas also help to control erosion.

Because of the slope and the moderately slow or slow permeability, this soil is poorly suited to septic tank absorption fields. The restricted permeability can be overcome by installing the absorption field in suitable fill material, by installing the distribution lines slightly closer to the surface, or by alternating the distribution of effluent into two absorption fields. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface.

Low strength and the high shrink-swell potential are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material.

The land capability classification is IIIe. The woodland ordination symbol is 2c.

ZnB—Zanesville silt loam, 1 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on broad ridgetops. Slopes are generally smooth or slightly convex. Most areas range from 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 55 inches thick. It is mottled below a depth of about 23 inches. The upper part is yellowish brown and dark yellowish brown, friable silt loam and silty clay loam; the next part is a fragipan of yellowish brown, very firm and brittle silty clay loam; and the lower part is light yellowish brown, firm channery clay loam. The substratum is strong brown, mottled, firm channery clay loam. Hard, olive brown siltstone bedrock is at a depth of about 75 inches.

Included with this soil in mapping are narrow strips of the moderately deep, well drained Gilpin soils near slope breaks. These soils make up 10 to 15 percent of most areas.

Permeability is moderate above the fragipan in the Zanesville soil and moderately slow or slow in the fragipan. A seasonal high water table is at a depth of 24 to 36 inches. Roots are restricted mostly to the 24- to 32-inch zone above the fragipan and to the widely spaced, vertical cracks within the fragipan. Available water capacity is moderate. Runoff is medium in cultivated areas. The shrink-swell potential is low. The potential for frost action is high. Unless the soil is limed, the subsoil is strongly acid or very strongly acid.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay. Cultivated crops can be grown year after year if erosion is controlled. In cultivated areas the hazard of erosion is moderate. 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, a cropping sequence that includes grasses and legumes, incorporation of crop residue into the plow layer, cover crops, contour farming, and stripcropping reduce the hazard of erosion and help to maintain tilth and the organic matter content. Tilling within the proper range of moisture content helps to prevent excessive compaction. The soil is well suited to no-till. A subsurface drainage system generally is needed only in intensively used areas, such as those where specialty crops are grown. Maintaining stands of deep-rooted legumes, such as alfalfa, is difficult in many areas because of the acid subsoil, the seasonal wetness, and the high potential for frost action.

Many areas are pastured. This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. The soil is poorly suited to winter grazing. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

A few areas are wooded. This soil is moderately well suited to trees and is well suited to habitat for woodland wildlife. Mowing, spraying, and disking help to control plant competition.

Because of the seasonal wetness, this soil is only moderately well suited to buildings. It is better suited to houses without basements than to houses with basements. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. If possible, the buildings should be constructed in areas where the fragipan is less compact.

Because of the slow or moderately slow permeability and the wetness, this soil is poorly suited to septic tank absorption fields. The restricted permeability can be overcome by installing the absorption field in suitable fill material, by installing the distribution lines as shallow as possible, and by alternating the flow of effluent into two absorption fields. Installing perimeter drains around the absorption fields reduces the seasonal wetness.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIe. The woodland ordination symbol is 3a.

ZnC—Zanesville silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on rounded ridgetops and, to a lesser extent, on wide benches. Most areas on the ridgetops are 150 to 300 feet wide. Slopes are typically smooth and convex. Most areas range from 3 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 55 inches thick. The upper part is yellowish brown and dark yellowish brown, friable silt loam and silty clay loam; the next part is a fragipan of yellowish brown, mottled, very firm and brittle silty clay loam; and the lower part is light yellowish brown, firm channery clay loam. The substratum is strong brown, mottled, firm channery clay loam. Hard, olive brown siltstone bedrock is at a depth of about 75 inches.

Included with this soil in mapping are small areas of the well drained Wellston soils and narrow strips of the moderately deep, well drained Gilpin soils. Also included are spots of severely eroded soils near slope breaks. Included soils make up about 15 to 20 percent of most areas.

Permeability is moderate above the fragipan in the Zanesville soil and moderately slow or slow in the fragipan. A seasonal high water table is at a depth of 24 to 36 inches. Roots are restricted mostly to the 24- to 32-inch zone above the fragipan and to the widely spaced, vertical cracks within the fragipan. Available water capacity is moderate. Runoff is rapid in cultivated areas. The potential for frost action is high. The shrink-swell potential is low. Unless the soil is limed, the root zone is strongly acid or very strongly acid.

Most areas are used as cropland or pasture. This soil is moderately well suited to corn, soybeans, and small grain and is well suited to grasses and legumes for hay. If the soil is cultivated or the protective plant cover is removed, the hazard of erosion is severe. If conservation measures are applied, a common rotation includes a cultivated or small grain crop every other year. A system of conservation tillage that leaves crop residue on the surface, a cropping sequence that includes grasses and legumes, incorporation of crop residue into the plow layer, contour stripcropping, and cover crops reduce the hazard of erosion. Tilling within the proper range of moisture content helps to prevent excessive compaction. The soil is well suited to no-till. Maintaining stands of alfalfa is difficult because of the restricted root zone, the high potential for frost action, the acid subsoil, and the seasonal wetness.

This soil is well suited to pasture. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard. Proper stocking rates, pasture rotation, mowing to control weeds, and timely applications of lime and fertilizer help to maintain a good stand of the key forage plants. The soil is poorly suited to winter grazing. Restricted grazing in winter and during other wet periods helps to prevent excessive compaction.

Some areas are wooded. This soil is moderately well suited to trees and is well suited to habitat for woodland wildlife. Mowing, spraying, and disking help to control plant competition.

Because of the slope and the seasonal wetness, this soil is only moderately well suited to buildings. It is better suited to houses without basements than to houses with basements. The buildings should be designed so that they conform to the natural slope of the land. The more convex parts of slopes are the best sites for buildings. If possible, the buildings should be constructed in areas where the fragipan is less compact. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Water moves downslope along the top of the fragipan. Installing interceptor drains upslope from the buildings helps to control this water. Maintaining as much vegetation on the site as possible during construction helps to control erosion.

Because of the seasonal wetness and the moderately slow or slow permeability in the fragipan, this soil is poorly suited to septic tank absorption fields. The effluent seeps downslope along the top of the fragipan. Installing the distribution lines across the slope helps to prevent excessive seepage of effluent to the surface. The restricted permeability can be overcome by installing the distribution lines as shallow as possible and by alternating the flow of effluent into two absorption fields. Installing interceptor drains upslope from the absorption fields helps to remove excess water.

Low strength and frost action are limitations on sites for local roads and streets. The damage caused by these limitations can be minimized by providing suitable base material and by installing a drainage system.

The land capability classification is IIIe. The woodland ordination symbol is 3a.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture (*14*). 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 43,000 acres in the survey area, or about 16 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the northern and western parts, mainly in associations 2, 4, 6, and 7, which are described under the heading "General Soil Map Units." Most of this 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 surface mining. 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 interpretive groups. The groups for each map unit are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

Leigh Mantell, district conservationist, Soil Conservation Service, and Hank Bartholomew, county extension 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.

In 1982, about 137,000 acres in Perry County, or 52 percent of the total acreage, was used as farmland (*6*). This acreage included about 44,000 acres of cropland. Of this cropland, 23,700 acres was used for corn, 13,500 acres for hay; 3,100 acres for wheat; 1,400 acres for soybeans; and 1,400 acres for oats. The rest of the cropland was used for nursery crops, small fruits, and vegetables.

The paragraphs that follow describe the main concerns in managing the cropland and pasture in Perry County. These concerns are water erosion, drainage, droughtiness, fertility, and tilth.

Water erosion is the major management concern on most of the cropland and some of the pasture in the county. It can result in the removal of the surface layer of the soil. This is the layer that over the years has received most of the residue from the native and cultivated plants that have grown on the soil. The addition of this residue results in a higher organic matter content in the surface layer than in the rest of the soil. The organic matter is responsible for the darker color of the surface layer. Because of its higher organic matter content, the surface layer is capable of storing and releasing more available water and plant nutrients than other layers in the soil. Thus, loss of the surface layer considerably reduces the nutrient-supplying capacity of the soil.

The subsoil of Homewood, Centerburg, Guernsey, and many other soils in the county has a higher clay content than the surface layer. If the surface layer is eroded, the plow layer contains a considerable amount of the more clayey subsoil material. As a result, tillage is difficult, tilth is poor, and a seedbed cannot be easily prepared.

Erosion reduces the depth to root-restricting layers, thus reducing the volume of soil available for root development. The root zone is restricted in Cincinnati, Homewood, and Zanesville soils. In moderately deep soils, such as Gilpin and Dekalb, the root zone is restricted by the depth to bedrock.

Measures that control erosion help to maintain the productive capacity of the soil. Several measures can be used to reduce the susceptibility to erosion. These include conservation tillage, contour farming, contour stripcropping, a cropping sequence that includes forage crops, management of crop residue, and grassed waterways.

No-till or other kinds of conservation tillage that leave crop residue on the surface are effective in controlling erosion on most of the soils in the county. They help to control erosion by reducing the amount of soil exposed to the impact of raindrops and the flow of runoff. They are suitable on both smooth and irregular slopes. On some of the wetter soils, such as Bennington, a good drainage system is needed if conservation tillage is to be effective. Contour farming, contour stripcropping, and grassed waterways can be used along with conservation tillage to further reduce the susceptibility to erosion.

Contour farming, or tilling across the slope, is quite effective on gently sloping soils that have a slope of 1 to 8 percent. For example, Alford and Cincinnati soils, which commonly have uniform slopes, generally can be easily tilled across the slope. The soils on short, irregular slopes, such as Centerburg, generally cannot be uniformly tilled across the slope.

Contour stripcropping has been used extensively in the county for many years, mainly on soils that have rather uniform slopes of 1 to 25 percent. It is used in many areas of the gently sloping to moderately steep Cincinnati and Homewood soils, which commonly are on smooth, uniform slopes. This practice is not practical in areas where slopes are short and irregular, such as many areas of the gently sloping or strongly sloping Amanda and Centerburg soils.

Management of crop residue and a cropping sequence that includes forage crops are equally applicable to smooth and irregular slopes. Returning crop residue to the soil helps to control erosion by reducing the impact of raindrops on the surface. Close-growing forage crops help to control erosion by reducing the runoff rate. The applicability of forage as an erosion-control measure depends to a large extent on the type of farming enterprise.

Grassed waterways can be established in low areas where runoff tends to collect and flow, especially if these areas are elongated. Gullies can form in such areas if water flows rapidly across a bare surface. Grassed waterways can be established in these gullies. Subsurface drains can carry off the normal flow in these areas, and any excess surface water can be carried off by the grassed waterways. Besides preventing the formation of gullies, the grassed waterways help to prevent flooding and overwashing of crops.

Pastures are subject to erosion. Many permanent pastures are in moderately steep or steep areas where runoff is very rapid. The key to erosion control in pastured areas is maintaining a thick sod cover. Overgrazing, which damages this cover, increases soil loss. Applying fertilizer and lime and mowing to control weeds tend to increase the density of the stand and thus help to control erosion. Many of the pastures in Perry County are on slopes that can be used occasionally for cultivated crops. Special care is needed to prevent excessive erosion when these slopes are cultivated. No-till methods of pasture seeding permit resodding with a minimum of soil loss.

Soil drainage is an important management problem in Perry County. Most plant roots do not grow well without oxygen. Very little oxygen is available in soils that are saturated with water. Wet soils remain cold in spring. They warm up earlier if the excess water is removed. Wetness also limits the use of farm machinery. Livestock compact wet, soft soils, damaging pasture plants.

Areas used for alfalfa and winter small grain require a better surface and subsurface drainage system than is needed in areas used for corn and soybeans. Late-planted soybeans are grown in some areas that are not drained adequately for most other crops.

Many of the naturally wet soils are highly productive when adequately drained. Their natural wetness has reduced or prevented the oxidation of organic matter and the leaching of carbonates. As a result, these soils are higher in natural fertility than the better drained soils nearby.

Each soil series in the county is assigned to a drainage class. Alford soils, for example, are well drained, Bennington soils are somewhat poorly drained, and Luray soils are very poorly drained. Drainage classes are based on the depth to and duration of the seasonal high water table during the wettest part of the year, usually late in winter or early in spring. The classes are determined by the depth to the water table under natural conditions and do not relate to the adequacy of a drainage system.

Most of the soils in Perry County are permeable enough to be adequately drained by properly designed and installed subsurface drains that have good outlets. The lack of suitable outlets is a problem in some soils. In these soils open ditches are generally constructed to provide outlets. Measures that maintain the ditches are needed.

Droughtiness is not a major problem on the soils used as cropland in Perry County. Lakin, Dekalb, Bethesda, Fairpoint, and Enoch are the more droughty soils in the county. Except for Lakin soils and some areas of Dekalb soils, these soils generally are not used as cropland. Occasional shortages of available moisture occur in many soils. They are most common in soils that have a limited depth to bedrock, such as Dekalb and Gilpin, or soils that have a fragipan, such as Cincinnati, Homewood, and Zanesville. Many of the more droughty soils are well suited to no-till or other systems of conservation tillage that leave crop residue on the surface. The crop residue conserves moisture for crop use. Some soils can be irrigated.

The effects of drought are more evident in pastures than in cultivated fields. Grasses in most pastured areas of the moderately steep and steep soils on south-facing slopes grow very slowly during the dry part of the summer. The growth rates can be increased on these soils by renovating the pasture and planting drought-tolerant species, such as alfalfa and orchardgrass.

Soil fertility is affected by the content of plant nutrients, lime, and organic matter in the soil. Measures that maintain fertility are needed on all soils in the county, regardless of other problems. The productivity of a soil depends on the natural fertility, past use and management, and the long-term fertility history. These factors differ widely from farm to farm, even on the same soil. A regular program of soil testing is needed to determine the amount and kind of fertilizer to be applied.

The amount and kind of fertilizer to be applied can differ widely among types of soil. Soils that have a high content of clay and organic matter, such as Luray and Pewamo soils, have a high capacity to store and release plant nutrients. Soils that have a low content of clay and a moderately low content of organic matter, such as Dekalb and Lakin soils, have a low capacity. If the soil is very acid, much of the phosphate fertilizer applied combines with iron and aluminum and is not available to plants. Earthworms, which incorporate plant residue into the soils, are more active if reaction is nearly neutral. Their activity results in better soil structure and a higher organic matter content.

Additions of organic material are very beneficial on most of the soils in the county. Organic matter is a very good source of nitrogen. It improves soil structure and tilth. It also has a capacity to store and release plant nutrients. As a result, additions of organic matter improve the ability of the soil to provide nutrients to crops. They are especially effective in restoring the productivity of severely eroded spots.

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

Most of the soils used as cropland in Perry County have a silt loam surface layer that is moderate or moderately low in organic matter content. The content of clay in this layer is about 20 percent and that of sand 15 to 25 percent. The clay content does not cause excessive stickiness. Because of relatively weak structure and a high content of silt, however, a crust forms at the surface after heavy rainfall. The crust is hard when dry. It reduces the rate of water infiltration, increases the runoff rate, and hinders seedling emergence.

Fall plowing is not suitable in Perry County because it increases the susceptibility of the soil to crusting and erosion. Leaving crop residue on the surface helps to prevent excessive crusting. Regular additions of crop residue, manure, and other organic material also reduce the susceptibility to crusting and improve soil structure.

Soils that have a high content of clay in the surface layer, such as Pewamo silty clay loam, are sticky when wet. If these soils are worked when they are too wet, soil particles stick together and form into clods. The surface layer of eroded soils is more likely to clod than that of uneroded soils because it has a slightly higher clay content. Additions of organic material help to maintain or improve tilth.

Management of Disturbed Land

By 1983, about 26,000 acres of land in Perry County had been affected by surface mining. About 95 percent of this land was mined prior to the 1972 Ohio reclamation law. It generally consists of graded and ungraded ridges and spoil piles in areas where no soil material has been replaced. The soils in these areas are mapped as Bethesda, Fairpoint, and Enoch soils.

The legislation enacted in 1972 required the restoration of all land mined in the future. The land must be restored to the approximate original contour and blanketed with topsoil and subsoil from natural soils. Bethesda silt loam, 0 to 8 percent slopes, and Bethesda silt loam, 8 to 20 percent slopes, were reclaimed by this technique. These soils make up about 1,300 acres in Perry County. They are better suited to agricultural production than unreclaimed mined land, but they still have limitations that should be overcome.

The current law requires that soils identified as prime farmland be replaced in a natural sequence to a depth of as much as 48 inches following mining. Most soils in surface-mined areas do not meet the requirements for prime farmland. As a result, most of the mined land is being reclaimed with a minimum of 6 inches of soil material overlying the spoil.

Soil properties should be considered in managing these soils. The organic matter content is considerably lower in formerly mined soils than in natural soils. A high bulk density is common in both the replaced soil material and the underlying graded spoil. The compaction is a result of the use of heavy machinery, especially wheeled reclamation equipment; excessive handling of topsoil material when it is stockpiled and spread; mining and reclamation activities performed under unfavorable moisture conditions; and insufficient time for soil-forming processes to decrease the bulk density. The high bulk density reduces the available water capacity and retards plant growth. As a result, it reduces crop yields.

Typically, the content of rock fragments in mine spoil is 35 to 60 percent, compared to 0 to 15 percent in the surface layer of most soils. Rock fragments reduce the thickness of the effective root zone and the available water capacity in formerly mined soils. Roots tend to concentrate in the part of the profile where soil and rock fragments adjoin. Few roots penetrate the compact, massive spoil material.

Planting suitable forage species increases the organic matter content, improves soil structure, reduces bulk density, and increases the water infiltration rate, pore space, and root growth in formerly mined soils. Forage species are better soil-building crops than row crops. They are also more effective in reducing the susceptibility to runoff and erosion. Thin stands should be reseeded. Conservation tillage methods of seedbed preparation that keep plant residue on the surface, including no-till planting, reduce the hazard of erosion. Companion crops also reduce this hazard.

Formerly mined soils generally are unsuited to grazing in winter, when they are wet. Winter grazing can result in compaction and damage to the plants and can increase the erosion hazard. Frequent, light applications of fertilizer are better suited to these soils than larger applications because of the loss of plant nutrients through runoff and the concentration of roots in the upper few inches of the soils.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

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

Crops other than those shown in table 6 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 (*16*). 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 limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Woodland Management and Productivity

Dave Berna, woodland conservationist, Soil Conservation Service, and Richard Cappell, service forester, Ohio Department of Natural Resources, Division of Forestry, helped prepare this section.

Woodland is an important land use in Perry County. In 1967, about 116,500 acres, or nearly 45 percent of the county, was wooded (*12*). The wooded acreage consists mainly of privately owned stands of timber and farm woodlots. The Forest Service owns 18,307 acres in the southern part of the county. This acreage is part of the Wayne National Forest. The most extensive wooded areas are in the Westmoreland-Bethesda-Guernsey and Westmoreland-Guernsey-Zanesville associations, which are dominantly in the southern and east-central parts of the county.

The woodland consists mainly of mixed hardwoods. The dominant woodland species are oak, yellow-poplar, black cherry, red maple, sugar maple, ash, and beech. Most of the wooded acreage occurs as areas of steep and very steep soils that formed in residuum and colluvium derived from sandstone, siltstone, limestone, and shale bedrock. Guernsey, Westmoreland, Dekalb, and Brownsville are the dominant soils. Many of the narrow ridgetops and flood plains also are wooded. Woodland is not a dominant land use, however, on the wider ridgetops and flood plains that are better suited to farming. The wooded acreage has increased in recent years, particularly in the steeper areas. Many abandoned areas have been planted to trees, mainly eastern white pine.

In places the woodland shows the result of abuse and neglect. Heavy cutting without planning for future timber production has resulted in understocked stands of trees near maturity. High grading has continually removed the best trees and left diseased or damaged trees, which take up valuable growing space on soils that are excellent woodland sites. Low-value white elm and hollow beech and poorly formed black cherry and red maple now cover thousands of acres where yellow-poplar, oak, black walnut, and sugar maple were once prevalent. Grazing has damaged or destroyed the leaf litter and desirable seedlings, has damaged roots, and has resulted in compaction. In most wooded areas grapevines have not been controlled. Good management can restore this woodland to a higher level of production. Additional information about woodland management can be obtained from the local offices of the Soil Conservation Service and the Ohio Department of Natural Resources, Division of Forestry.

Soils differ greatly in their productivity as woodland (*5*). The factors that influence the growth of trees are almost the same as those that influence the production of annual crops and forage. The major difference is that tree roots extend deeper into the soil, especially around rock fragments in the lower part of the soil. The direction of exposure, or aspect, and the position of the soil on the landscape are also important. Other properties to be considered are the slope, the degree of past erosion, the acidity, and the fertility level.

Aspect is the direction in which a slope faces. Trees grow better on north and east aspects because of less exposure to the prevailing wind and the sun and because soil moisture is more abundant. South and west aspects are less suitable for woodland because of a higher soil temperature resulting from more direct sunrays, high evaporation by the prevailing wind, an earlier snowmelt, and a greater degree of freezing and thawing.

The position of the soil on the landscape is important in determining the moisture supply for the growth of trees. The supply of soil moisture increases as elevation decreases, partly because of downslope seepage. Also, the soils on the lower part of slopes are generally deeper than those on the upper part, lose less moisture through evaporation, and have a somewhat lower temperature.

The slope is an important factor in woodland management. Steep and very steep slopes seriously limit the use of equipment. As the percent of slope increases, the rate of water infiltration decreases and the rate of runoff and the hazard of erosion increase.

Erosion reduces the volume of soil available for water storage. Severe erosion removes the surface layer and exposes the subsoil. Because the subsoil is commonly less porous, the runoff rate increases and the rate of water intake decreases. Both tree growth and natural reseeding are adversely affected.

Soil reaction and fertility influence the growth of trees. For example, black walnut grows better on Amanda and Nolin soils than on other soils. The natural content of lime in the subsoil of these soils favors the growth of this species. The growth rate is slower on soils that are low in fertility.

Christmas trees have been grown in a few areas of the county. They can grow well on many of the soils but are adversely affected by various soil properties. Drainage and texture affect the species that can be successfully grown. For example, blue spruce and Fraser fir do not grow well on poorly drained and somewhat poorly drained soils, such as Peoga, Luray, and

Fitchville. Fraser fir does not grow well on Upshur soils, which have a fine textured subsoil. Other factors are fertility, the available water capacity, the potential for frost action, and the depth to bedrock. Wellston and Westmoreland soils are better suited to spruce and fir than Brownsville and Dekalb soils because they have a higher available water capacity, are deeper to bedrock, and are more fertile.

Table 8 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 suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excessive 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*, high content of coarse fragments in the soil profile. 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 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

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

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

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

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

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

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

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, 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 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 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 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, 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 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

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

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

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

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

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 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife (*1*). This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, smartweed, ragweed, and fall panicum.

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, beech, 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 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, cattails, willow, 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, pheasant, 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, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

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

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or 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 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, 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 toxic substances 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 13 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 13 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 13 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 13 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 14 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, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are 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 14, 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 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 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, 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. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. 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 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 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 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. 6). "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.

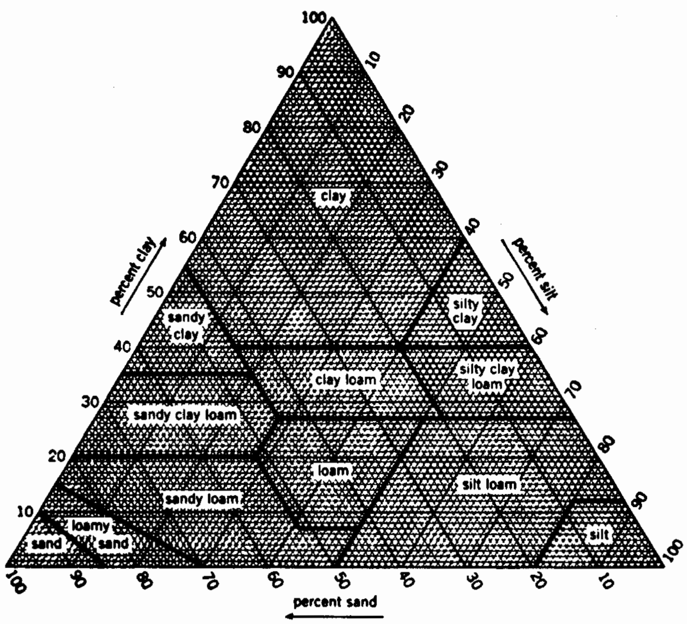

Figure 6.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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.

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 17 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 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to 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 17, 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 of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to two hydrologic groups in table 18, 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, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 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 18 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 18.

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.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is 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 Perry County were sampled by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained from 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. Five pedons were selected as representative of their respective series and are described in the section "Soil Series and Their Morphology." These series and their laboratory identification numbers are Alford series (PR-10), Dekalb series (PR-15), Gilpin series (PR-5), Guernsey series (PR-12), and Westmoreland series (PR-11).

In addition to the data from Perry County, laboratory data are also available from nearby counties that have many of the same soils. These data and the data from Perry County are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series 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 (*17*). 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 20 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 Alfisol.

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 Aqualf (*Aqu*, meaning water, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of 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 Ochraqualfs (*Ochr*, meaning light colored surface layer, plus *aqualf*, the suborder of the Alfisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Ochraqualfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Typic Ochraqualfs.

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* (*15*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*17*). 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."

Alford Series

The Alford series consists of deep, well drained, moderately permeable soils. These soils formed in loess on ridgetops in the uplands, on benches, and in covelike areas. Slope ranges from 1 to 25 percent.

These soils have a lower base saturation at a depth of about 60 inches than is definitive for the Alford series. This difference, however, does not affect the usefulness or behavior of the soils.

Alford soils are similar to Mentor, Wellston, and Westmore soils and are commonly adjacent to Cincinnati and Wellston soils. Cincinnati soils have a fragipan.

Mentor soils are on terraces. They contain gravel and have more sand in the lower part than the Alford soils. Wellston soils have a higher content of coarse fragments in the lower part than the Alford soils. Cincinnati and Wellston soils are on side slopes and ridgetops. They have a loess mantle that is thinner than that of the Alford soils. Westmore soils have more clay in the lower part than the Alford soils.

Typical pedon of Alford silt loam, 1 to 8 percent slopes, in Hopewell Township; 1,500 feet east and 1,280 feet south of the northwest corner of sec. 16, T. 17 N., R. 16 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common roots; neutral; abrupt smooth boundary.

Bt1—10 to 18 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; common faint clay films on faces of peds; common faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; neutral; clear smooth boundary.

Bt2—18 to 25 inches; brown (7.5YR 5/4) silt loam; moderate medium subangular blocky structure; firm; common roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; neutral; gradual smooth boundary.

Bt3—25 to 33 inches; yellowish brown (10YR 5/4) silt loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; thin very patchy light yellowish brown (10YR 6/4) silt coatings on faces of peds; slightly acid; gradual smooth boundary.

Bt4—33 to 41 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; firm; few roots; few distinct brown (7.5YR 4/4) clay films on faces of peds and in pores; medium acid; gradual smooth boundary.

BC—41 to 57 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; friable; few faint brown (7.5YR 4/4) clay films on vertical faces of peds; medium acid; gradual smooth boundary.

C—57 to 80 inches; yellowish brown (10YR 5/6) silt loam; massive; very friable; strongly acid.

The solum ranges from 50 to 60 inches in thickness. Reaction ranges from neutral to very strongly acid in the solum and from strongly acid to neutral in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and 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.

Amanda Series

The Amanda series consists of deep, well drained, moderately slowly permeable soils. These soils formed in Wisconsinan glacial till on uplands. Slope ranges from 2 to 18 percent.

Amanda soils are similar to Centerburg soils and are commonly adjacent to Bennington and Centerburg soils. The somewhat poorly drained Bennington and moderately well drained Centerburg soils are commonly in the less sloping areas.

Typical pedon of Amanda silt loam, 6 to 12 percent slopes, eroded, in Thorn Township; 2,600 feet south and 660 feet east of the northwest corner of sec. 18, T. 18 N., R. 17 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; common roots; about 5 percent pebbles; specks of dark yellowish brown (10YR 4/4) subsoil material; slightly acid; abrupt smooth boundary.

Bt1—8 to 17 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common roots; few faint brown (7.5YR 4/4) clay films and pale brown (10YR 6/3) silt coatings on faces of peds; about 5 percent pebbles; strongly acid; gradual wavy boundary.

Bt2—17 to 33 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few roots; few faint clay films on faces of peds; about 5 percent pebbles; strongly acid; gradual wavy boundary.

BC—33 to 45 inches; brown (10YR 4/3) clay loam; weak coarse subangular blocky structure; firm; about 5 percent coarse fragments; medium acid; clear wavy boundary.

C—45 to 80 inches; brown (10YR 4/3) loam; massive; firm; about 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 70 inches. The content of gravel-size coarse fragments ranges from 0 to 10 percent in the upper part of the solum, from 2 to 15 percent in the lower part of the solum, and from 5 to 15 percent in the C horizon. Reaction is medium acid to very strongly acid in the Bt horizon, medium acid to mildly alkaline in the BC horizon, and neutral to moderately alkaline in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is typically silt loam but is loam or silty clay loam in some pedons. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. In many pedons it has mottles of high chroma throughout; however, it has mottles of low chroma only in the lower part. It is clay loam or silty clay loam. The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is loam or silt loam.

Bennington Series

The Bennington series consists of deep, slowly permeable, somewhat poorly drained soils. These soils formed in Wisconsinan glacial till on flats, in small depressions, and along small drainageways in the uplands. Slope ranges from 0 to 3 percent.

Bennington soils are commonly adjacent to Amanda, Centerburg, and Pewamo soils. The well drained Amanda and moderately well drained Centerburg soils are in the higher positions on the landscape. The poorly drained and very poorly drained Pewamo soils are in depressions and along small drainageways.

Typical pedon of Bennington silt loam, 0 to 3 percent slopes, in Thorn Township; 1,940 feet west and 1,300 feet north of the southeast corner of sec. 7, T. 18 N., R. 17 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium and coarse subangular blocky structure parting to weak fine granular; friable; many roots; about 1 percent coarse fragments; slightly acid; abrupt smooth boundary.

E—10 to 13 inches; grayish brown (2.5Y 5/2) silt loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; common roots; common faint dark gray (10YR 4/1) silt coatings on faces of peds, light gray (10YR 7/1) dry; few concretions (iron and manganese oxides); about 1 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—13 to 26 inches; yellowish brown (10YR 5/6) silty clay loam; many fine distinct grayish brown (2.5Y 5/2) mottles; moderate fine and medium subangular blocky structure; firm; common roots; many distinct dark gray (10YR 4/1) and few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—26 to 44 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct yellowish brown (10YR 5/8) and dark gray (10YR 4/1) mottles; moderate medium subangular blocky structure; firm; few roots; many distinct gray (10YR 5/1) clay films on faces of peds; about 10 percent coarse fragments; neutral; gradual smooth boundary.

C1—44 to 52 inches; brown (10YR 4/3) loam; few fine distinct gray (10YR 5/1) and yellowish brown (10YR 5/8) mottles; massive; firm; about 10 percent coarse fragments; slight effervescence grading to strong effervescence at a depth of about 48 inches; mildly alkaline; gradual smooth boundary.

C2—52 to 80 inches; brown (10YR 4/3) loam; massive; firm; about 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 28 to 50 inches. The depth to carbonates ranges from 26 to 46 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. Thin subhorizons that have chroma of 2 are in some pedons. The Bt horizon is silty clay loam, clay loam, or silty clay. It is medium acid to very strongly acid in the upper part and medium acid to neutral in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is loam, silty clay loam, or clay loam.

Bethesda Series

The Bethesda series consists of deep, well drained, moderately slowly permeable soils in surfaced-mined areas. These soils formed in a mixture of partly weathered fine earth and fragments of shale, sandstone, and siltstone. Slope ranges from 0 to 70 percent.

Bethesda soils are similar to Fairpoint soils and are commonly adjacent to Guernsey, Wellston, and Westmoreland soils. The adjacent soils have an argillic horizon. They are in unmined areas. Fairpoint soils are less acid in the substratum than the Bethesda soils.

Typical pedon of Bethesda channery loam, 40 to 70 percent slopes, in Clayton Township; 520 feet east and 1,700 feet north of the southwest corner of sec. 3, T. 16 N., R. 15 W.

Ap—0 to 3 inches; dark grayish brown (10YR 4/2) channery loam, olive brown (2.5Y 4/4) dry; weak medium granular structure; friable; many roots; about 20 percent shale and siltstone fragments; extremely acid; abrupt wavy boundary.

C1—3 to 17 inches; about 80 percent yellowish brown (10YR 5/4) and 20 percent gray (10YR 5/1) very channery clay loam; massive; friable; common roots; about 30 percent shale, 15 percent siltstone, and 10 percent sandstone fragments; extremely acid; clear smooth boundary.

C2—17 to 34 inches; about 90 percent yellowish brown (10YR 5/4) and 10 percent gray (10YR 5/1) very channery clay loam; massive; friable; few roots; about 20 percent siltstone, 15 percent shale, and 15 percent sandstone fragments; extremely acid; gradual smooth boundary.

C3—34 to 80 inches; about 95 percent yellowish brown (10YR 5/4) and 5 percent gray (10YR 5/1) very channery loam; massive; friable; about 40 percent sandstone, 10 percent siltstone, and 5 percent shale fragments; extremely acid.

The soils range from strongly acid to extremely acid throughout, except where the surface layer has been limed or where the surface has been covered with less acid soil material. Rock fragments are siltstone, sandstone, and shale and smaller amounts of coal and carbonaceous shale. They are mostly flat and are less than 10 inches long, but some pedons have stones and boulders. The content of rock fragments in the C horizon ranges from 35 to 80 percent and averages about 45 percent.

The Ap horizon has hue of 7.5YR or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 8. Its fine-earth fraction typically is loam or silt loam but is clay loam or silty clay loam in some pedons. Pedons in reclaimed areas have an Ap horizon of silt loam 4 to 12 inches thick. The C horizon has hue of 7.5YR to 5Y or is neutral in hue. It has value of 3 to 6 and chroma of 0 to 8. Its fine-earth fraction is silty clay loam, clay loam, silt loam, or loam.

Brownsville Series

The Brownsville series consists of deep, well drained soils formed in material weathered mainly from siltstone and from smaller amounts of fine grained sandstone. These soils are on uplands. Permeability is moderate or moderately rapid. Slope ranges from 40 to 70 percent.

Brownsville soils are similar to Dekalb soils and are commonly adjacent to Guernsey and Westmoreland soils. Dekalb soils are moderately deep to bedrock. Guernsey and Westmoreland soils have fewer coarse fragments in the subsoil than the Brownsville soils. They are in landscape positions similar to those of the Brownsville soils.

Typical pedon of Brownsville silt loam, 40 to 70 percent slopes, in Monroe Township; 1,000 feet south and 760 feet west of the northeast corner of sec. 21, T. 12 N., R. 14 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; very friable; many roots; about 10 percent siltstone fragments; strongly acid; abrupt smooth boundary.

Bw1—5 to 8 inches; yellowish brown (10YR 5/4) channery silt loam; weak medium subangular blocky structure; friable; common roots; few faint silt coatings on faces of peds; about 25 percent siltstone fragments; very strongly acid; clear smooth boundary.

Bw2—8 to 31 inches; yellowish brown (10YR 5/4) very channery silt loam; weak fine subangular blocky structure; friable; common roots; few faint silt coatings on faces of peds; about 55 percent siltstone fragments; strongly acid; gradual smooth boundary.

C1—31 to 39 inches; yellowish brown (10YR 5/4) extremely channery loam; massive; friable; few roots; about 80 percent siltstone fragments; very strongly acid; clear smooth boundary.

C2—39 to 50 inches; yellowish brown (10YR 5/4) extremely channery loam; massive; friable; about 90 percent siltstone fragments; very strongly acid; abrupt smooth boundary.

R—50 to 52 inches; fractured siltstone bedrock.

The thickness of the solum is typically 28 to 30 inches but ranges from 24 to 40 inches. The depth to bedrock ranges from 40 to 60 inches. Coarse fragments are siltstone or fine grained sandstone. They are mostly flat and are less than 10 inches in size. The content of coarse fragments ranges from 5 to 15 percent in the A horizon, from 15 to 75 percent in subhorizons of the B horizon, and from 30 to 90 percent in the C horizon. Unless the soils are limed, reaction ranges from strongly acid to extremely acid in the B horizon and from medium acid to extremely acid in the C horizon.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is typically silt loam but is channery silt loam in some pedons. The B horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 6. Its fine-earth fraction is silt loam or loam. The C horizon has colors and fine-earth textures similar to those of the B horizon. The bedrock is commonly fractured siltstone or fine grained sandstone that becomes harder with increasing depth.

Centerburg Series

The Centerburg series consists of deep, moderately well drained soils formed in Wisconsinan glacial till on uplands. Permeability is moderately slow. Slope ranges from 2 to 6 percent.

Centerburg soils are similar to Amanda soils and are commonly adjacent to Amanda and Bennington soils. Amanda soils are well drained and are commonly in the more sloping areas. Bennington soils are somewhat poorly drained and in the lower positions on the landscape.

Typical pedon of Centerburg silt loam, 2 to 6 percent slopes, in Thorn Township; 260 feet west and 1,600 feet south of the center of sec. 21, T. 18 N., R. 17 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many roots; about 1 percent coarse fragments; neutral; abrupt smooth boundary.

Bt1—8 to 12 inches; dark yellowish brown (10YR 4/4) clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common roots; common faint clay films and few faint brown (10YR 5/3) silt coatings on faces of peds; few fine black (10YR 2/1) concretions; about 5 percent coarse fragments; neutral; clear smooth boundary.

Bt2—12 to 31 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few roots; common faint dark grayish brown (10YR 4/2) clay films on faces of peds; common fine black (10YR 2/1) concretions; about 5 percent coarse fragments; slightly acid; clear wavy boundary.

BC—31 to 36 inches; dark yellowish brown (10YR 4/4) loam; common fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few roots; common faint dark grayish brown (10YR 4/2) clay films on faces of peds; common fine black (10YR 2/1) concretions; about 10 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

C—36 to 80 inches; dark yellowish brown (10YR 4/4) loam; common fine distinct yellowish brown (10YR 5/6) and light gray (10YR 6/1) mottles; massive; firm; about 12 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 50 inches. Some pedons have a silty mantle, which is 0 to 18 inches thick. The content of gravel is 0 to 10 percent throughout the solum. The gravel is mainly siltstone and sandstone and a few crystalline rocks.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is typically clay loam, but in some pedons it is loam or has thin layers of silt loam or silty clay loam. It is strongly acid to neutral. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is loam or silt loam. It is mildly alkaline or moderately alkaline.

Cincinnati Series

The Cincinnati series consists of deep, well drained soils formed in loess and in the underlying Illinoian glacial till. These soils are on uplands. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in and below the fragipan. Slope ranges from 1 to 15 percent.

Cincinnati soils are similar to Zanesville soils and are commonly adjacent to Alford and Homewood soils. Alford soils do not have a fragipan. They have a loess mantle that is thicker than that of the Cincinnati soils. They are on the broader ridgetops. Homewood soils are commonly on the steeper slopes. They have more sand and coarse fragments in the upper part than the Cincinnati soils. Zanesville soils do not have glacial pebbles in the lower part.

Typical pedon of Cincinnati silt loam, 8 to 15 percent slopes, eroded, in Reading Township; 1,200 feet east and 440 feet south of the center of sec. 24, T. 16 N., R. 16 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many roots; medium acid; abrupt smooth boundary.

Bt1—8 to 24 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—24 to 31 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

2Btx1—31 to 38 inches; strong brown (7.5YR 5/6) silty clay loam; weak very coarse prismatic structure parting to weak coarse subangular blocky; very firm; brittle; few roots; common distinct brown (7.5YR 5/4) clay films on faces of prisms; common distinct pale brown (10YR 6/3) silt coatings on faces of prisms; thin very patchy brown (7.5YR 4/4) clay films on secondary faces of peds; about 3 percent gravel; strongly acid; clear smooth boundary.

2Btx2—38 to 56 inches; strong brown (7.5YR 5/6) silty clay loam; moderate very coarse prismatic structure parting to weak thick platy; very firm; brittle; common distinct grayish brown (10YR 5/2) and brown (7.5YR 5/4) clay films on faces of prisms; many faint yellowish brown (10YR 5/4) silt coatings on faces of prisms; few distinct brown (7.5YR 4/4) clay films on secondary faces of peds; about 5 percent gravel; strongly acid; gradual smooth boundary.

2BC—56 to 80 inches; strong brown (7.5YR 5/6) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few distinct brown (7.5YR 4/4) clay films on faces of peds; about 5 percent gravel; strongly acid.

The thickness of the loess mantle is typically 24 to 32 inches but ranges from 18 to 40 inches. The thickness of the solum ranges from 48 to 90 inches. Unless the soils are limed, the B horizon is strongly acid or very strongly acid within a depth of 40 inches. The content of coarse fragments, mostly of gravel size, ranges from 2 to 15 percent in the glacial till.

The Ap horizon has hue of 10YR, value of 4 or 5, and 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 2Btx horizon is loam, clay loam, or silty clay loam.

Dekalb Series

The Dekalb series consists of moderately deep, well drained, rapidly permeable soils formed in residuum and colluvium derived from medium and coarse grained sandstone. These soils are on ridgetops and hillsides. Slope ranges from 8 to 70 percent.

Dekalb soils are similar to Brownsville soils and are commonly adjacent to Guernsey and Westmoreland soils. Brownsville, Guernsey, and Westmoreland soils are deep to bedrock. Guernsey and Westmoreland soils are in landscape positions similar to those of the Dekalb soils. They are underlain mainly by interbedded siltstone and shale and have more clay and fewer coarse fragments than the Dekalb soils.

Typical pedon of Dekalb loam, 40 to 70 percent slopes, very stony, in Monroe Township; 1,720 feet west and 2,080 feet north of the southeast corner of sec. 22, T. 12 N., R. 14 W.

Oe—1 inch to 0; leaf litter from deciduous trees.

A—0 to 3 inches; black (10YR 2/1) loam, gray (10YR 5/1) dry; moderate very fine granular structure; very friable; many roots; about 10 percent sandstone fragments; stones 10 to 25 feet apart on the surface; extremely acid; abrupt irregular boundary.

BA—3 to 5 inches; yellowish brown (10YR 5/4) loam; weak fine granular structure; very friable; many roots; about 10 percent sandstone fragments; extremely acid; clear wavy boundary.

Bw1—5 to 18 inches; yellowish brown (10YR 5/6) channery loam; weak fine and medium subangular blocky structure; friable; common roots; about 25 percent sandstone fragments; extremely acid; gradual smooth boundary.

Bw2—18 to 30 inches; yellowish brown (10YR 5/6) very flaggy sandy loam; weak medium subangular blocky structure; friable; common roots; about 55 percent sandstone fragments; extremely acid; abrupt smooth boundary.

R—30 to 35 inches; fractured, light olive brown (2.5Y 5/6), medium grained sandstone bedrock; yellowish brown (10YR 5/6) loamy sand in cracks 0.5 to 1.0 inch wide; cracks are more than 4 inches apart to a depth of 35 inches.

The thickness of the solum ranges from 20 to 36 inches, and the depth to bedrock ranges from 20 to 40 inches. The content of flat or angular sandstone fragments increases with increasing depth. It ranges from 10 to 60 percent in the B horizon and from 50 to 90 percent in the C horizon. Most coarse fragments are less than 10 inches in size. Unless limed, these soils are strongly acid to extremely acid throughout.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. It is typically loam but is sandy loam in some pedons. The B horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 6. Its fine-earth fraction is loam or sandy loam. The C horizon has colors similar to those of the B horizon. Its fine-earth fraction is sandy loam or loamy sand.

Enoch Series

The Enoch series consists of deep, well drained soils in surface-mined areas. These soils formed in a mixture of ultra acid, partly weathered fine earth and coarse fragments. The coarse fragments are mainly ultra acid, carbonaceous roof shale and sandstone and smaller amounts of siltstone and coal. Permeability is moderately slow. Slope ranges from 20 to 40 percent.

Enoch soils are commonly adjacent to Bethesda, Guernsey, and Westmoreland soils. Bethesda soils are less acid throughout than the Enoch soils. Guernsey and Westmoreland soils are in unmined areas. They have an argillic horizon.

Typical pedon of Enoch shaly clay loam, 20 to 40 percent slopes, in Clayton Township; 1,600 feet east and 1,100 feet south of the northwest corner of sec. 16, T. 16 N., R. 15 W.

Ap—0 to 1 inch; grayish brown (2.5Y 5/2) shaly clay loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; about 30 percent coarse fragments of black shale and light brownish gray sandstone; ultra acid; abrupt smooth boundary.

C1—1 to 9 inches; light gray (5Y 6/1) extremely shaly silty clay loam; massive; friable; about 60 percent dark gray shale and 10 percent black carbonaceous shale fragments; ultra acid; clear wavy boundary.

C2—9 to 30 inches; about 70 percent gray (5Y 6/1) and 30 percent light olive brown (2.5Y 5/4) very shaly silty clay loam; massive; friable; about 30 percent dark gray shale and 5 percent black carbonaceous shale fragments; ultra acid; clear wavy boundary.

C3—30 to 80 inches; light olive brown (2.5Y 5/6) and light gray (5Y 6/1) shaly silty clay loam; massive; friable; about 15 percent gray shale and 10 percent black carbonaceous shale fragments; ultra acid.

The soils are ultra acid (pH 1.5 to 3.4) throughout, except where the surface layer has been limed. Rock fragments are mainly gray or dark shale and smaller amounts of sandstone. Most are flat and are less than 10 inches long, but large stones are in a few areas. The content of coarse fragments, by weighted average, is 35 to 50 percent in the control section.

The Ap horizon has hue of 7.5YR to 5Y or is neutral in hue. It has value of 2 to 6 and chroma of 0 to 6. The C horizon has hue of 7.5YR to 5Y, value of 2 to 6, and chroma of 1 to 8. It has fine-earth textures of loam, silty clay loam, clay loam, or sandy clay loam.

Euclid Series

The Euclid series consists of deep, somewhat poorly drained, moderately slowly permeable soils formed in silty deposits on low stream terraces. Slope ranges from 0 to 3 percent.

Euclid soils are similar to Fitchville soils and are commonly adjacent to Killbuck, Luray, and Mentor soils. Fitchville soils have an argillic horizon. Killbuck soils have a dark buried A horizon. They are on flood plains and are frequently flooded. Luray soils are very poorly drained and are on stream terraces and in old glacial lake basins. Mentor soils are well drained and are in the higher positions on terraces.

Typical pedon of Euclid silt loam, rarely flooded, in Hopewell Township; 2,240 feet north and 60 feet west of the southeast corner of sec. 5, T. 17 N., R. 16 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; many roots; medium acid; abrupt smooth boundary.

Bw1—10 to 14 inches; yellowish brown (10YR 5/6) silt loam; common medium prominent light gray (10YR 6/1) and common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; many distinct grayish brown (10YR 5/2) silt coatings on faces of peds; dark grayish brown (10YR 4/2) fillings in old root channels; strongly acid; clear wavy boundary.

Bw2—14 to 23 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; friable; few roots; many distinct light gray (10YR 6/1) silt coatings on faces of peds; many distinct grayish brown (10YR 5/2) silt coatings on vertical faces of prisms; black oxide stains and concretions; strongly acid; gradual wavy boundary.

Bw3—23 to 30 inches; brown (7.5YR 5/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; few roots; many distinct light gray (10YR 6/1) and grayish brown (10YR 5/2) silt coatings on vertical faces of prisms; strongly acid; gradual wavy boundary.

Bw4—30 to 41 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and light gray (10YR 6/1) mottles; moderate fine and medium subangular blocky structure; friable; few roots; many distinct grayish brown (10YR 5/2) silt coatings on faces of peds; medium acid; gradual wavy boundary.

BC—41 to 50 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and light gray (10YR 6/1) mottles; weak medium subangular blocky structure; friable; common distinct grayish brown (10YR 5/2) silt coatings on faces of peds; medium acid; gradual wavy boundary.

C—50 to 80 inches; dark yellowish brown (10YR 4/4) silty clay loam; many coarse distinct gray (10YR 5/1) and few medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; slightly acid.

The solum ranges from 35 to 55 inches in thickness. Unless the soils are limed, reaction ranges from very strongly acid to medium acid in the solum and from medium acid to neutral in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5 (6 or more dry), and chroma of 2 or 3. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. It is silt loam or silty clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is typically silt loam or silty clay loam but has thin strata of loam or fine sandy loam in some pedons.

Fairpoint Series

The Fairpoint series consists of deep, well drained, moderately slowly permeable soils in surface-mined areas. These soils formed in a mixture of partly weathered fine earth and fragments of fine grained sandstone and siltstone and neutral or calcareous shale. Slope ranges from 8 to 70 percent.

Fairpoint soils are similar to Bethesda soils and are commonly adjacent to Guernsey, Westmore, and Westmoreland soils. Bethesda soils are more acid in the substratum than the Fairpoint soils. Guernsey, Westmore, and Westmoreland soils have an argillic horizon. They are in unmined areas.

Typical pedon of Fairpoint channery clay loam, 40 to 70 percent slopes, in Clayton Township; 3,200 feet north and 380 feet west of the southeast corner of sec. 23, T. 16 N., R. 15 W.

Ap—0 to 5 inches; olive (5Y 5/3) channery clay loam, pale olive (5Y 6/3) dry; weak medium subangular blocky structure; firm; common roots; about 20 percent fragments of siltstone and fine grained sandstone; many distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; neutral; clear smooth boundary.

C1—5 to 45 inches; about 60 percent olive (5Y 5/3), 20 percent grayish brown (2.5Y 5/2), and 20 percent olive brown (2.5Y 4/4) very channery clay loam; massive; firm; few roots; about 45 percent fragments of siltstone, fine grained sandstone, and some shale; dominantly thin flat stone fragments less than 6 inches across, some as much as 15 inches across and others rounded; dominantly neutral but with few mildly alkaline spots that are slightly effervescent; clear wavy boundary.

C2—45 to 80 inches; about 80 percent light olive brown (2.5Y 5/4) and 20 percent yellowish brown (10YR 5/6) very channery clay loam; massive; firm; about 55 percent fragments of siltstone, fine grained sandstone, and some shale; dominantly neutral but with few mildly alkaline spots that are slightly effervescent.

The soils generally are medium acid to neutral throughout, but thin zones or spots are mildly alkaline. The content of rock fragments ranges from 20 to 80 percent in the substratum and averages about 45 percent. Most of the fragments are flat and are less than 10 inches across, but stones and boulders are in a few areas. The fragments are dominantly siltstone, fine grained sandstone, and neutral or calcareous shale.

The Ap horizon has hue of 7.5YR to 5Y, value of 3 to 6, and chroma of 1 to 6. It is dominantly channery clay loam but is channery silty clay loam, gravelly clay loam, or gravelly silty clay loam in some pedons. The C horizon has hue of 7.5YR to 5Y or is neutral in hue. It has value of 3 to 6 and chroma of 0 to 8. Its fine-earth fraction is clay loam, silty clay loam, silt loam, or loam.

Fitchville Series

The Fitchville series consists of deep, somewhat poorly drained, moderately slowly permeable soils. These soils formed in silty lacustrine sediments on terraces along streams and in old glacial lake basins. Slope ranges from 0 to 3 percent.

Fitchville soils are similar to Euclid soils and are commonly adjacent to Glenford and Luray soils. Euclid soils do not have an argillic horizon. Glenford soils are moderately well drained and commonly are in the slightly higher positions on the landscape. Luray soils are very poorly drained and are generally in the slightly lower positions.

Typical pedon of Fitchville silt loam, 0 to 3 percent slopes, in Reading Township; 528 feet south and 165 feet west of the northeast corner of sec. 1, T. 17 N., R. 17 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

E—9 to 12 inches; grayish brown (10YR 5/2) silt loam; few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium platy structure; friable; common roots; few black (10YR 2/1) oxide stains; very strongly acid; clear smooth boundary.

Bt1—12 to 18 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common roots; many distinct light gray (10YR 7/1) silt coatings and common distinct grayish brown (10YR 5/2) clay films on faces of peds; few black (10YR 2/1) oxide stains; very strongly acid; gradual smooth boundary.

Bt2—18 to 32 inches; yellowish brown (10YR 5/6) silty clay loam; many medium faint yellowish brown (10YR 5/8) and common medium distinct grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; few roots; many distinct light gray (10YR 7/1) silt coatings and common distinct gray (10YR 5/1) clay films on faces of prisms; few black (10YR 2/1) oxide stains; strongly acid; gradual wavy boundary.

Bt3—32 to 37 inches; yellowish brown (10YR 5/6) silt loam; many medium faint yellowish brown (10YR 5/8) and common medium prominent grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate coarse subangular blocky; friable; few roots; common distinct light gray (10YR 7/1) silt coatings and many distinct gray (10YR 5/1) clay films on faces of peds and in pores; few black (10YR 2/1) oxide stains; strongly acid; gradual smooth boundary.

Bt4—37 to 49 inches; yellowish brown (10YR 5/6) silt loam; many medium faint yellowish brown (10YR 5/8) and many medium prominent gray (10YR 6/1) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; friable; few distinct dark grayish brown (10YR 4/2) and gray (10YR 5/1) clay films in pores and on faces of peds; thin (about 0.25 inch) lenses and pockets of fine sandy loam; medium acid; gradual smooth boundary.

BC—49 to 60 inches; yellowish brown (10YR 5/6) silty clay loam; many medium prominent light brownish gray (10YR 6/2) and many medium faint yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; friable; gray (10YR 5/1) silt coatings on vertical faces of peds; few black (10YR 2/1) oxide stains; slightly acid; clear wavy boundary.

C—60 to 80 inches; yellowish brown (10YR 5/6) silty clay loam; many medium prominent light brownish gray (10YR 6/2) and many medium faint yellowish brown (10YR 5/8) mottles; massive; friable; few black (10YR 2/1) oxide stains; neutral in the upper part; slight effervescence in the lower part.

The solum ranges from 35 to 70 inches in thickness. Unless the soils are limed, reaction is very strongly acid to medium acid in the upper part of the solum, medium acid to neutral in the lower part of the solum, and medium acid to mildly alkaline in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, chroma of 1 to 6. It is silt loam or silty clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, chroma of 2 to 6. It is commonly silt loam or silty clay loam but has thin lenses of fine sandy loam or loam in some pedons.

Gilpin Series

The Gilpin series consists of moderately deep, well drained, moderately permeable soils formed in material weathered from fine grained sandstone, siltstone, and shale. These soils are on uplands. Slope ranges from 8 to 25 percent.

Gilpin soils are similar to Westmoreland soils and are commonly adjacent to Guernsey, Wellston, Westmoreland, and Zanesville soils. The adjacent soils are deep. They are commonly on the broader ridgetops.

Typical pedon of Gilpin silt loam, 15 to 25 percent slopes, in Monroe Township; 150 feet north and 80 feet west of the center of sec. 31, T. 12 N., R. 14 W.

Oe—1 inch to 0; decayed leaf litter.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many roots; strongly acid; abrupt wavy boundary.

E—3 to 6 inches; pale brown (10YR 6/3) silt loam; weak coarse subangular blocky structure parting to weak medium platy; very friable; many roots; about 1 percent coarse fragments; extremely acid; clear wavy boundary.

Bt1—6 to 9 inches; brown (7.5YR 5/4) silt loam; moderate coarse subangular blocky structure; friable; few roots; few distinct reddish brown (5YR 5/4) clay films on faces of peds and in pores; common faint pale brown (10YR 6/3) silt coatings on faces of peds; about 2 percent coarse fragments; extremely acid; gradual smooth boundary.

Bt2—9 to 13 inches; brown (7.5YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; few roots; many distinct brown (7.5YR 4/4) clay films on faces of peds and in pores; about 5 percent coarse fragments; extremely acid; clear wavy boundary.

Bt3—13 to 18 inches; brown (7.5YR 5/4) channery silty clay loam; moderate fine subangular blocky structure; firm; few roots; common distinct reddish brown (5YR 4/4) clay films on faces of peds and rock fragments; about 25 percent coarse fragments; extremely acid; clear wavy boundary.

Bt4—18 to 22 inches; brown (7.5YR 5/4) very channery silty clay loam; moderate fine subangular blocky structure; firm; few roots; many distinct reddish brown (5YR 4/4) clay films on faces of peds and rock fragments; few fine black (10YR 2/1) concretions (iron and manganese oxides); about 40 percent coarse fragments; extremely acid; clear wavy boundary.

C—22 to 37 inches; brown (7.5YR 5/4) extremely channery silt loam; massive; firm; about 70 percent fragments of light olive brown (2.5Y 5/6) siltstone; common distinct reddish brown (5YR 5/4) clay films and black (10YR 2/1) stains (iron and manganese oxides) on rock fragments; very strongly acid; clear smooth boundary.

R—37 to 40 inches; light olive brown (2.5Y 5/6), fractured, thinly bedded siltstone bedrock.

The solum ranges from 20 to 36 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments ranges from 0 to 15 percent in the A horizon, from 2 to 40 percent in the Bt horizon, and from 30 to 90 percent in the C horizon. The coarse fragments are mostly flat pieces of sandstone and siltstone. Unless limed, the soils are strongly acid to extremely acid in the solum.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 6. The C horizon has hue of 7.5YR to 2.5Y and value and chroma of 4 to 6. The fine-earth fraction of the Bt and C horizons is silt loam, loam, or silty clay loam.

Glenford Series

The Glenford series consists of deep, moderately well drained, moderately slowly permeable soils. These soils formed in stratified, silty lacustrine sediments on terraces along streams and in old glacial lake basins. Slope ranges from 1 to 8 percent.

Glenford soils are similar to Mentor soils and are commonly adjacent to Fitchville, Luray, and Mentor soils. The somewhat poorly drained Fitchville and very poorly drained Luray soils are in the lower positions on the landscape. The well drained Mentor soils are in the slightly higher positions. They have a higher content of gravel in the lower part than the Glenford soils.

Typical pedon of Glenford silt loam, 1 to 8 percent slopes, in Reading Township; 1,000 feet south and 400 feet west of the northeast corner of sec. 1, T. 17 N., R. 17 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

BA—10 to 13 inches; 60 percent dark grayish brown (10YR 4/2) and 40 percent yellowish brown (10YR 5/4) silt loam; few medium faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; few distinct very pale brown (10YR 7/3) silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—13 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; few medium distinct strong brown (7.5YR 5/8) mottles; moderate medium angular blocky structure; firm; few roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few distinct very pale brown (10YR 7/3) silt coatings; few fine concretions and stains; medium acid; clear wavy boundary.

Bt2—21 to 44 inches; yellowish brown (10YR 5/6) silt loam; few medium prominent gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; friable; few roots; few distinct dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) clay films on faces of peds; few concretions and stains; thin strata of very fine sandy loam; medium acid; gradual wavy boundary.

BC—44 to 58 inches; yellowish brown (10YR 5/6) silt loam; few medium prominent gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; friable; few thin strata of fine sandy loam; few concretions and stains; medium acid; gradual smooth boundary.

C—58 to 80 inches; yellowish brown (10YR 5/6) stratified silt loam and silty clay loam; few medium prominent gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/8) mottles; massive; friable; thin strata of fine sandy loam; medium acid.

The solum ranges from 30 to 60 inches in thickness. Unless the soils are limed, reaction ranges from very strongly acid to medium acid in the upper part of the solum and from medium acid to neutral in the lower part. It ranges from medium acid to mildly alkaline in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly silt loam or silty clay loam but has thin strata of loam, fine sandy loam, or very fine sandy loam. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is commonly stratified silt loam and silty clay loam but has thin strata of loam, fine sandy loam, or silty clay.

Guernsey Series

The Guernsey series consists of deep, moderately well drained soils on ridges, benches, and hillsides. These soils formed in colluvium and in the underlying material weathered from siltstone, shale, and thin layers of limestone and sandstone. Permeability is moderately slow or slow. Slope ranges from 8 to 70 percent.

Guernsey soils are commonly adjacent to the well drained Westmore and Westmoreland soils. Westmore soils have less clay in the upper part of the subsoil than the Guernsey soils. They are mainly on ridgetops and benches. Westmoreland soils have a lower content of clay and a higher content of coarse fragments in the subsoil and substratum than the Guernsey soils. They are on ridgetops and side slopes.

Typical pedon of Guernsey silt loam, in an area of Guernsey-Westmoreland silt loams, 25 to 40 percent slopes, in Monroe Township; 1,400 feet north and 350 feet east of the southwest corner of sec. 13, T. 12 N., R. 14 W.

Oe—0.5 inch to 0; leaves and leaf litter.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; very friable; many roots; about 2 percent fragments of siltstone and sandstone; medium acid; abrupt wavy boundary.

E1—3 to 7 inches; brown (10YR 5/3) silt loam; weak fine subangular blocky structure parting to weak fine granular; friable; many roots; brown (10YR 4/3) organic coatings and streaks on faces of peds; about 2 percent fragments of siltstone; very strongly acid; clear wavy boundary.

E2—7 to 14 inches; pale brown (10YR 6/3) silt loam; weak medium subangular blocky structure; friable; common roots; common distinct brown (10YR 4/3) silt coatings on faces of peds; about 10 percent fragments of siltstone and sandstone; extremely acid; clear wavy boundary.

Bt1—14 to 17 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; few faint brown (10YR 5/3) clay films and common faint brown (10YR 5/3) silt coatings on faces of peds; about 5 percent fragments of siltstone; extremely acid; clear smooth boundary.

2Bt2—17 to 28 inches; light olive brown (2.5Y 5/4) silty clay loam; common fine distinct light brownish gray (2.5Y 6/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few roots; common distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent fragments of siltstone; strongly acid; clear smooth boundary.

2Bt3—28 to 34 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct gray (10YR 5/1) mottles; moderate medium angular blocky structure; firm; few roots; many distinct grayish brown (10YR 5/2) and few distinct yellowish brown (10YR 5/4) clay films on faces of peds; few black (10YR 2/1) concretions; about 10 percent fragments of siltstone; neutral; abrupt wavy boundary.

2BC—34 to 56 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct gray (10YR 6/1) mottles; weak coarse subangular blocky structure; firm; few roots; common distinct grayish brown (10YR 5/2) clay films on faces of peds; common distinct reddish brown (5YR 4/4) clay films on faces of peds in the lower part; common medium black (10YR 2/1) concretions; about 10 percent fragments of siltstone; strong effervescence; moderately alkaline; gradual smooth boundary.

2C—56 to 62 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; firm; about 10 percent fragments of siltstone and sandstone; strong effervescence; moderately alkaline; clear smooth boundary.

2Cr—62 to 65 inches; gray (10YR 5/1), calcareous shale bedrock; yellowish brown and reddish brown stains on fractured surfaces.

The solum ranges from 36 to 60 inches in thickness. The depth to bedrock ranges from 50 to 80 inches. The content of coarse fragments ranges from 2 to 20 percent in the 2Bt horizon and from 5 to 35 percent in the 2C horizon. The coarse fragments are mostly thin, flat pieces of siltstone and shale and some pieces of limestone and sandstone. Unless the soils are limed, reaction ranges from extremely acid to medium acid in the upper part of the solum, from strongly acid to moderately alkaline in the 2Bt and 2BC horizons, and from strongly acid to moderately alkaline in the 2C horizon.

The A horizon has hue of 10YR and value and chroma of 2 or 3. The Ap horizon has value of 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam, silty clay, clay, or the shaly analogs of these textures. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is silty clay loam, silty clay, clay, or the shaly analogs of these textures.

Homewood Series

The Homewood series consists of deep, moderately well drained and well drained soils formed in Illinoian glacial till. These soils are on uplands. They have a fragipan. Permeability is moderate above the fragipan and slow in and below the fragipan. Slope ranges from 15 to 40 percent.

Homewood soils are commonly adjacent to Cincinnati, Killbuck, and Westmoreland soils. Cincinnati soils are in the less sloping areas. Their loess mantle is more than 18 inches thick. Killbuck soils are poorly drained and are on flood plains. Westmoreland soils do not have a fragipan. They are commonly on the upper part of slopes.

Typical pedon of Homewood silt loam, in an area of Homewood-Westmoreland silt loams, 15 to 25 percent slopes, eroded, in Jackson Township; 1,920 feet east and 150 feet south of the northwest corner of sec. 17, T. 15 N., R. 16 W.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure in the upper part grading to weak medium subangular blocky in the lower part; friable; many roots; about 1 percent gravel; specks of brown (7.5YR 5/4) subsoil material; strongly acid; abrupt smooth boundary.

Bt1—7 to 13 inches; brown (7.5YR 5/4) silt loam; moderate fine and medium subangular blocky structure; friable; common roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; about 1 percent gravel; strongly acid; abrupt smooth boundary.

Bt2—13 to 18 inches; yellowish brown (10YR 5/6) loam; moderate fine and medium subangular blocky structure; friable; common roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; few distinct brown (10YR 5/3) silt coatings on faces of peds; few fine black concretions; about 5 percent gravel; very strongly acid; clear smooth boundary.

Btx1—18 to 28 inches; yellowish brown (10YR 5/6) clay loam; few fine faint brown (10YR 5/3) mottles; moderate coarse prismatic structure parting to weak thick platy; very firm; about 50 percent brittle zones; few roots along faces of prisms; common distinct brown (7.5YR 4/4) clay films on faces of prisms; few fine black concretions; about 7 percent gravel; very strongly acid; clear smooth boundary.

Btx2—28 to 46 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure parting to moderate medium angular blocky; very firm; brittle; few fine roots along faces of prisms; common distinct dark grayish brown (10YR 4/2) and brown (7.5YR 4/4) clay films on faces of prisms; about 10 percent gravel; very strongly acid; gradual smooth boundary.

BC—46 to 68 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; common distinct dark grayish brown (10YR 4/2) and brown (7.5YR 4/4) clay films on faces of peds; about 5 percent gravel; strongly acid in the upper part and medium acid in the lower part; gradual smooth boundary.

C1—68 to 72 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct gray (10YR 5/1) mottles; massive; firm; about 5 percent gravel; slightly acid; diffuse wavy boundary.

C2—72 to 80 inches; variegated yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and dark reddish brown (2.5YR 3/4) loam; common fine distinct gray (10YR 5/1) mottles; massive; friable; about 3 percent gravel; slightly acid.

The solum is more than 60 inches thick. Some pedons have a loess mantle, which is as much as 16 inches thick. Unless the soils are limed, reaction is strongly acid or very strongly acid in the Bt and Btx horizons and strongly acid to neutral in the C horizon. The content of gravel-size coarse fragments ranges from 0 to 10 percent above the fragipan and from 3 to 15 percent in and below the fragipan.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam, silty clay loam, loam, or silt loam. The Btx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, or clay loam. The C horizon has colors similar to those of the Btx horizon. It is loam or clay loam.

Killbuck Series

The Killbuck series consists of deep, poorly drained, moderately slowly permeable soils on flood plains. These soils formed in silty recent alluvium overlying a buried soil that has a dark surface horizon. Slope is 0 to 2 percent.

Killbuck soils are commonly adjacent to Homewood, Luray, Newark, and Nolin soils. The adjacent soils do not have a dark buried surface horizon. Homewood soils are on uplands. Luray soils are on low terraces. Newark and Nolin soils are on flood plains.

Typical pedon of Killbuck silt loam, frequently flooded, in Reading Township; 2,200 feet south and 2,000 feet east of the northwest corner of sec. 21, T. 16 N., R. 16 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; few fine red (2.5YR 4/6) stains; many roots; slightly acid; clear smooth boundary.

Cg—7 to 19 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct dark yellowish brown (10YR 4/4) and brown (10YR 4/3) mottles; moderate medium subangular blocky structure; friable; common roots; strata of grayish brown (10YR 5/2) and brown (10YR 5/3) very fine sandy loam about 1 inch thick; slightly acid; clear wavy boundary.

2Ab—19 to 31 inches; very dark gray (N 3/0) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few roots; dark gray (N 4/0) organic coatings on faces of peds; common dark yellowish brown (10YR 3/4) oxides; slightly acid; clear wavy boundary.

2Bgb—31 to 46 inches; gray (N 5/0) silty clay loam; common medium distinct reddish brown (2.5YR 4/4) mottles; weak coarse subangular blocky structure; firm; few roots; common fine distinct strong brown (7.5YR 5/6) stains; slightly acid; gradual wavy boundary.

2Cg—46 to 80 inches; gray (N 5/0) loam; massive; friable; few roots; thin strata of fine sandy loam; slightly acid.

The silty recent alluvium is 15 to 36 inches deep over the buried A horizon. Reaction is medium acid to neutral in the recent alluvium and medium acid to mildly alkaline in the buried soil.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. The Cg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silt loam or silty clay loam. The 2Ab horizon also is silt loam or silty clay loam. It is 6 to 15 inches thick. It has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The 2Bg and 2Cg horizons have hue of 10YR to 5Y or are neutral in hue. They have value of 4 to 6 and chroma of 0 to 2. They are dominantly silty clay loam, loam, or silt loam but in some pedons have thin bands of fine sandy loam below a depth of 40 inches.

Lakin Series

The Lakin series consists of deep, excessively drained, rapidly permeable soils formed in coarse textured, water-deposited material on terraces. Slope ranges from 1 to 8 percent.

Lakin soils are commonly adjacent to Alford, Newark, and Nolin soils. The adjacent soils have more silt and clay and less sand throughout the solum than the Lakin soils. Alford soils are in the higher positions on the landscape. Newark and Nolin soils are on flood plains.

Typical pedon of Lakin loamy sand, 1 to 8 percent slopes, in Harrison Township; 1,215 feet north and 240 feet west of the center of sec. 28, T. 14 N., R. 14 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, dark brown (10YR 3/3), rubbed, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; common roots; neutral; abrupt smooth boundary.

E—8 to 26 inches; yellowish brown (10YR 5/4) loamy sand; weak very fine granular structure; very friable; few roots; neutral; gradual wavy boundary.

E&Bt—26 to 60 inches; yellowish brown (10YR 5/4) loamy sand (E); single grained; loose; brown (7.5YR 4/4) sandy loam lamellae and lumps (Bt); very weak medium granular structure; very friable; clay bridges between sand grains; medium acid; gradual wavy boundary.

C—60 to 80 inches; brown (10YR 4/3) loamy sand; common medium faint yellowish brown (10YR 5/4) mottles; single grained; loose; common black (10YR 2/1) concretions; medium acid.

The solum ranges from 50 to more than 80 inches in thickness. Unless the soils are limed, reaction is strongly acid or medium acid in the control section.

The Ap horizon has hue of 10YR, value of 3 to 5 (6 dry), and chroma of 2 to 4. The E horizon has value of 5 or 6 and chroma of 4 to 6. The E part of the E&Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is loamy sand or sand. The Bt part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4. It is loamy fine sand, loamy sand, or sandy loam. The combined thickness of the lamellae in the particle-size control section is less than 5.5 inches. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loamy sand or sand.

Linwood Series

The Linwood series consists of deep, very poorly drained soils formed in organic deposits over mineral material. The organic deposits were derived from woody material, grasses, sedges, and reeds. These soils are in bogs in outwash valleys. Permeability is moderately slow to moderately rapid in the organic layers and moderate in the loamy material. Slope is 0 to 2 percent.

Linwood soils are commonly adjacent to Luray and Ockley soils. The adjacent soils formed in mineral material. They are in the higher positions on stream terraces.

Typical pedon of Linwood muck, in Thorn Township; 2,200 feet south and 1,200 feet west of the northeast corner of sec. 10, T. 18 N., R. 17 W.

Oa1—0 to 7 inches; black (N 2/0), broken face and rubbed, sapric material; moderate medium granular structure; very friable; many roots; less than 1 percent woody fragments; neutral; clear wavy boundary.

Oa2—7 to 16 inches; black (N 2/0), broken face and rubbed, sapric material; about 5 percent fiber, none rubbed; moderate coarse subangular blocky structure; very friable; common roots; less than 1 percent woody fragments; neutral; gradual wavy boundary.

Oa3—16 to 24 inches; black (10YR 2/1), broken face, and black (N 2/0), rubbed, sapric material; about 15 percent fiber, none rubbed; moderate coarse subangular blocky structure; very friable; less than 1 percent woody fragments; neutral; gradual wavy boundary.

Oa4—24 to 38 inches; very dark grayish brown (10YR 3/2), broken face, very dark brown (10YR 2/2), rubbed, sapric material; about 20 percent fiber, less than 5 percent rubbed; massive; very friable; about 1 percent woody fragments; neutral; abrupt smooth boundary.

2Cg—38 to 80 inches; gray (5Y 5/1) silt loam; massive; friable; neutral.

The organic material ranges from 16 to 50 inches in thickness. The organic part of the control section below the surface tier ranges from medium acid to mildly alkaline.

The subsurface tier has hue of 10YR or 2.5Y or is neutral in hue. It is value of 2 or 3 and chroma of 0 to 3. It is dominantly sapric material, but it may have as much as 10 inches of hemic material. The 2Cg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is silt loam, loam, or silty clay loam. It ranges from slightly acid to mildly alkaline.

Luray Series

The Luray series consists of deep, very poorly drained soils formed in silty lacustrine sediments. These soils generally are on terraces and in old glacial lake basins. In some areas they are on outwash plains. Permeability is moderately slow. Slope is 0 to 2 percent.

Luray soils are similar to Pewamo soils and are commonly adjacent to Euclid, Fitchville, and Killbuck soils. Euclid and Fitchville soils are somewhat poorly drained. Euclid soils are on the lower terraces along streams, and Fitchville soils are in the slightly higher positions on the landscape. Killbuck soils formed in light colored recent alluvium over a dark buried soil. They are poorly drained and are on flood plains. Pewamo soils have rounded glacial pebbles and more clay throughout than the Luray soils.

Typical pedon of Luray silt loam, in Thorn Township; 800 feet east and 600 feet north of the center of sec. 10, T. 18 N., R. 17 W.

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

A—9 to 13 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; moderate coarse granular structure; friable; common roots; neutral; clear smooth boundary.

BA—13 to 16 inches; dark gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; common fine distinct brown (7.5YR 4/4) mottles; moderate fine and medium subangular blocky structure; friable; common roots; slightly acid; clear irregular boundary.

Btg—16 to 27 inches; gray (10YR 5/1) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common roots; very dark gray (10YR 3/1) fillings in krotovinas; common faint grayish brown (10YR 5/2) clay films on faces of peds; neutral; gradual smooth boundary.

Bt—27 to 42 inches; yellowish brown (10YR 5/6) silty clay loam; common medium prominent gray (10YR 5/1) mottles; weak medium subangular blocky structure; firm; few roots; few distinct dark gray (10YR 4/1) clay films on vertical faces of peds; very dark gray (10YR 3/1) fillings in krotovinas; neutral; gradual smooth boundary.

Cg—42 to 80 inches; grayish brown (2.5Y 5/2) silt loam; common medium prominent yellowish brown (10YR 5/6) and many medium faint gray (10YR 5/1) mottles; massive; weak stratification (bedding); friable; neutral in the upper part; slightly effervescent and mildly alkaline at a depth of about 54 inches.

The solum ranges from 30 to 60 inches in thickness. The mollic epipedon is 10 to 18 inches thick and extends into the B horizon in some pedons. Reaction is medium acid to neutral in the solum and slightly acid to moderately alkaline in the C horizon.

The Ap and A horizons have hue of 10YR, value of 2 or 3 (4 or 5 dry), and chroma of 1 or 2. They are typically silt loam but are silty clay loam in some pedons. The Bt and Btg horizons have hue of 10YR to 5Y or are neutral in hue. They have value of 4 to 6 and chroma of 0 to 6. The are silty clay loam or silt loam. The C horizon has color ranges similar to those of the Bt horizon. It is dominantly silt loam or silty clay loam, but it has thin strata of loam or fine sandy loam in some pedons.

Melvin Series

The Melvin series consists of deep, poorly drained, moderately permeable soils. These soils formed in recent alluvium in depressions on flood plains. Slope is 0 to 2 percent.

Melvin soils are commonly adjacent to the somewhat poorly drained Newark soils, which are in the slightly higher positions on the flood plains.

Typical pedon of Melvin silt loam, ponded, in Monroe Township; 2,534 feet east and 1,848 feet north of the southwest corner of sec. 21, T. 12 N., R. 14 W.

Ap—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (2.5Y 5/2) dry; weak coarse granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

AC—4 to 12 inches; dark grayish brown (2.5Y 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; common medium distinct olive brown (2.5Y 4/4) mottles; massive; friable; many roots; medium acid; abrupt smooth boundary.

Cg1—12 to 32 inches; gray (10YR 5/1) silt loam; many medium distinct olive brown (2.5Y 4/4) mottles; massive; friable; common roots; slightly acid; gradual wavy boundary.

Cg2—32 to 40 inches; dark gray (5Y 4/1) silt loam; few medium distinct greenish gray (5GY 5/1) and olive brown (2.5Y 4/4) mottles; massive; friable; common roots; slightly acid; gradual wavy boundary.

Cg3—40 to 54 inches; gray (5Y 5/1) silt loam; common medium distinct dark greenish gray (5GY 4/1) mottles; massive; friable; few roots; slightly acid; gradual smooth boundary.

Cg4—54 to 80 inches; gray (10YR 5/1) silt loam; massive; friable; common black (10YR 2/1) oxide concretions; neutral.

The solum is medium acid to neutral in the upper part and slightly acid or neutral in the lower part. The Ap horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 2 or 3. The C horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 4 to 7 and chroma of 0 to 2. It is stratified with loam to silty clay loam below a depth of 40 inches in some pedons.

Mentor Series

The Mentor series consists of deep, well drained, moderately permeable soils formed in silty deposits and in the underlying glacial outwash. These soils are on terraces. Slope ranges from 1 to 15 percent.

Mentor soils are similar to Alford, Glenford, Wellston, and Westmore soils and are commonly adjacent to Fitchville and Glenford soils. Alford soils are in the higher landscape positions. They have less sand and gravel in the lower part than the Mentor soils. The somewhat poorly drained Fitchville and moderately well drained Glenford soils are in the lower landscape positions. Wellston and Westmore soils are on uplands. Wellston soils have angular coarse fragments in the lower part. Westmore soils have more clay in the lower part than the Mentor soils.

Typical pedon of Mentor silt loam, gravelly substratum, 1 to 8 percent slopes, in Hopewell Township; 2,100 feet north and 1,000 feet west of the southeast corner of sec. 6, T. 17 N., R. 16 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; friable; many roots; slightly acid; abrupt smooth boundary.

Bt1—10 to 14 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; common faint brown (7.5YR 5/4) clay films on faces of peds; common distinct dark brown (10YR 3/3) organic coatings on faces of peds and in root channels; slightly acid; clear smooth boundary.

Bt2—14 to 26 inches; brown (7.5YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; few roots; common distinct dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt3—26 to 36 inches; brown (7.5YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few roots; common distinct dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt4—36 to 44 inches; brown (7.5YR 5/4) silt loam; weak coarse subangular blocky structure; friable; few roots; few distinct dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt5—44 to 60 inches; strong brown (7.5YR 5/6) gravelly sandy clay loam; weak coarse subangular blocky structure; friable; common distinct reddish brown (5YR 4/4) clay bridging between sand grains; about 30 percent small pebbles; medium acid; clear smooth boundary.

2C—60 to 80 inches; dark brown (7.5YR 4/2) gravelly sandy loam; single grained; friable; about 30 percent gravel; slightly acid within a depth of 70 inches and mildly alkaline below that depth.

The solum ranges from 36 to 60 inches in thickness. The depth to the gravelly substratum ranges from 40 to 60 inches. Unless the soils are limed, reaction ranges from very strongly acid to medium acid in the upper part of the Bt horizon, from strongly acid to slightly acid in the lower part of the Bt horizon and the upper part of the C horizon, and from slightly acid to mildly alkaline in the lower part of the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt and 2Bt horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The Bt horizon is silt loam or silty clay loam. The 2Bt horizon is loam, fine sandy loam, clay loam, sandy clay loam, or the gravelly analogs of these textures. The 2C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6.

Newark Series

The Newark series consists of deep, somewhat poorly drained, moderately permeable soils formed in recent alluvium on flood plains. Slope is 0 to 2 percent.

Newark soils are commonly adjacent to Melvin, Nolin, and Peoga soils. The poorly drained Melvin soils are in the lower positions on the flood plains. The well drained Nolin soils are in the higher positions on the flood plains. The poorly drained Peoga soils are on low terraces and are subject to rare flooding. They have an argillic horizon.

Typical pedon of Newark silt loam, frequently flooded, in Harrison Township; 600 feet north and 480 feet west of the southeast corner of sec. 32, T. 14 N., R. 14 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak medium subangular blocky structure parting to weak medium granular; friable; many roots; discontinuous very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) streaks, 1 to 2 inches thick, in the lower part; medium acid; abrupt smooth boundary.

Bw—10 to 17 inches; brown (10YR 4/3) silt loam; common medium faint dark grayish brown (10YR 4/2) and common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak coarse subangular blocky; friable; few roots; many distinct grayish brown (10YR 5/2) silt coatings on faces of peds; medium acid; abrupt smooth boundary.

Bg—17 to 44 inches; grayish brown (10YR 5/2) silt loam; common medium prominent strong brown (7.5YR 5/6) and common medium distinct dark gray (10YR 4/1) and dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure parting to weak medium granular; friable; few roots; few fine black concretions; medium acid; gradual smooth boundary.

Cg—44 to 80 inches; gray (10YR 5/1) silt loam; common fine prominent strong brown (7.5YR 5/6) mottles; massive; friable; slightly acid.

Unless limed, the soils are medium acid to neutral throughout. They are typically silt loam throughout. Below a depth of 40 inches, however, many pedons have thin layers of loam, silty clay loam, or fine sandy loam.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. The Bg horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. The Cg horizon has colors and textures similar to those of the Bg horizon.

Nolin Series

The Nolin series consists of deep, well drained, moderately permeable soils formed in recent alluvium on flood plains. Slope ranges from 0 to 3 percent.

Nolin soils are commonly adjacent to Killbuck and Newark soils in the lower positions on the flood plains. Killbuck soils are poorly drained. They formed in silty recent alluvium over a buried soil. Newark soils are somewhat poorly drained.

Typical pedon of Nolin silt loam, occasionally flooded, in Madison Township; 1,400 feet east and 300 feet south of the northwest corner of sec. 17, T. 17 N., R. 15 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

BA—6 to 17 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak coarse subangular blocky structure parting to moderate medium granular; friable; common roots; slightly acid; clear smooth boundary.

Bw1—17 to 22 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; common roots; common faint brown (10YR

4/3) organic coatings on faces of peds and in pores; slightly acid; clear smooth boundary.

Bw2—22 to 42 inches; brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; friable; few roots; few distinct pale brown (10YR 6/3) silt coatings on faces of peds; medium acid; clear smooth boundary.

Bw3—42 to 55 inches; brown (10YR 4/3) silt loam; few fine distinct grayish brown (10YR 5/2) and common medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; friable; few roots; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; medium acid; gradual wavy boundary.

C1—55 to 70 inches; brown (10YR 4/3) silt loam; few medium distinct dark gray (10YR 4/1) and many medium distinct dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) mottles; massive; friable; medium acid; gradual wavy boundary.

C2—70 to 80 inches; dark grayish brown (10YR 4/2) silt loam; many medium distinct dark yellowish brown (10YR 4/4), few medium faint dark gray (10YR 4/1), and common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; medium acid.

Unless limed, the soils are medium acid to neutral throughout. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is silty clay loam, silt loam, loam, fine sandy loam, or sandy loam. In some pedons it is stratified with these textures.

Ockley Series

The Ockley series consists of deep, well drained soils formed in Wisconsinan glacial outwash on terraces. Permeability is moderate in the solum and very rapid in the substratum. Slope ranges from 0 to 12 percent.

Ockley soils are commonly adjacent to Glenford, Luray, and Mentor soils. The adjacent soils contain more silt and less sand in the solum than the Ockley soils. They are on terraces and in old glacial lake basins.

Typical pedon of Ockley loam, 0 to 2 percent slopes, in Thorn Township; 1,100 feet east and 100 feet north of the center of sec. 3, T. 18 N., R. 17 W.

Ap—0 to 9 inches; brown (10YR 4/3) loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; many roots; about 3 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—9 to 13 inches; brown (7.5YR 4/4) loam; moderate fine subangular blocky structure; friable; common roots; many faint brown (10YR 4/3) organic coatings on faces of peds; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent gravel; slightly acid; clear wavy boundary.

Bt2—13 to 17 inches; brown (7.5YR 4/4) clay loam; moderate fine subangular blocky structure; friable; few roots; few faint brown (10YR 4/3) organic coatings on faces of peds; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 8 percent gravel; slightly acid; clear wavy boundary.

Bt3—17 to 29 inches; brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; friable; few roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 30 percent gravel; slightly acid; gradual smooth boundary.

Bt4—29 to 44 inches; brown (7.5YR 4/4) gravelly clay loam; weak medium subangular blocky structure; friable; few roots; common faint reddish brown (5YR 4/4) clay films on faces of peds; about 30 percent gravel; slightly acid; clear wavy boundary.

BC—44 to 49 inches; dark yellowish brown (10YR 3/4) very gravelly sandy loam; weak medium granular structure; very friable; clay bridging between sand grains; distinct reddish brown (5YR 4/4) clay films on pebbles; about 55 percent gravel; neutral; clear wavy boundary.

C—49 to 80 inches; yellowish brown (10YR 5/4) very gravelly loamy coarse sand; single grained; loose; about 55 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 40 to 60 inches. Unless the soils are limed, reaction is medium acid or strongly acid in the upper part of the solum, medium acid to neutral in the lower part of the solum, and mildly alkaline or moderately alkaline in the C horizon. The content of gravel ranges from 0 to 15 percent in the upper 17 inches and from 15 to 60 percent in the lower part of the solum. It averages less than 35 percent in the textural control section.

The Ap 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 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is the gravelly or very gravelly analogs of loamy coarse sand or sand. In some pedons it is stratified.

Peoga Series

The Peoga series consists of deep, poorly drained, slowly permeable soils formed in lacustrine sediments and loess. These soils are on low terraces. Slope is 0 to 2 percent.

Peoga soils are commonly adjacent to the somewhat poorly drained Newark soils on flood plains.

Typical pedon of Peoga silt loam, rarely flooded, in Jackson Township; 2,400 feet west and 2,400 feet north of the southeast corner of sec. 10, T. 15 N., R. 16 W.

Ap—0 to 10 inches; dominantly grayish brown (2.5Y 5/2) silt loam, light brownish gray (10YR 6/2) dry; dark grayish brown (10YR 4/2) in the upper 2 inches; common medium faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; many roots; slightly acid; abrupt smooth boundary.

Eg—10 to 19 inches; gray (10YR 6/1) silt loam; weak coarse subangular blocky structure; friable; common roots; many fine red (2.5YR 4/6) stains; slightly acid; abrupt smooth boundary.

Btg—19 to 48 inches; gray (10YR 6/1) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few roots; many faint gray (10YR 6/1) silt coatings and few distinct grayish brown (10YR 5/2) and brown (10YR 5/3) clay films on faces of peds; common fine red (2.5YR 4/6) stains; very strongly acid; gradual wavy boundary.

Cg—48 to 80 inches; gray (10YR 6/1) stratified silt loam and silty clay loam; many medium prominent yellowish brown (10YR 5/6 and 5/8) mottles; massive; firm; many fine red (2.5YR 4/6) stains; strongly acid.

The solum ranges from 48 to 64 inches in thickness. It is strongly acid or very strongly acid unless lime has been applied.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The E horizon has hue of 10YR, value of 4 to 7, and chroma of 1 or 2. It is silt loam or silty clay loam. The Bt horizon also is silt loam or silty clay loam. It has hue of 10YR to 5Y, value of 4 to 7, and chroma of 1 or 2. The C horizon has colors similar to those of the Bt horizon. It is mainly silt loam or silty clay loam but has thin strata of loam or fine sandy loam in some pedons. It is strongly acid or medium acid.

Pewamo Series

The Pewamo series consists of deep, poorly drained and very poorly drained soils formed in Wisconsinan glacial till. These soils are in depressions and along small drainageways in the uplands. Permeability is moderately slow. Slope is 0 to 2 percent.

Pewamo soils are similar to Luray soils and are commonly adjacent to Bennington and Centerburg soils. The somewhat poorly drained Bennington and moderately well drained Centerburg soils are in the slightly higher positions on the landscape. Luray soils have a lower content of clay and coarse fragments in the subsoil than the Pewamo soils.

Typical pedon of Pewamo silty clay loam, in Thorn Township; 500 feet north and 1,200 feet east of the center of sec. 16, T. 18 N., R. 17 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak medium angular blocky structure parting to weak coarse granular; friable; many roots; about 1 percent gravel; slightly acid; abrupt smooth boundary.

A—9 to 17 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak coarse granular; friable; common roots; about 1 percent gravel; slightly acid; clear smooth boundary.

Btg1—17 to 25 inches; dark gray (10YR 4/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) and few medium prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; common roots; common faint dark gray (10YR 4/1) clay films on faces of peds; common krotovinas filled with very dark gray (10YR 3/1) material; about 1 percent pebbles; neutral; gradual wavy boundary.

Btg2—25 to 35 inches; dark gray (10YR 4/1) silty clay loam; many medium faint dark grayish brown (10YR 4/2), many medium distinct dark yellowish brown (10YR 4/4), and few medium prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common roots; common faint dark gray (10YR 4/1) clay films on faces of peds; about 5 percent pebbles; neutral; gradual wavy boundary.

Btg3—35 to 48 inches; dark gray (10YR 4/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; few roots; few faint dark gray (10YR 4/1) clay films on faces of peds; about 5 percent pebbles; neutral; gradual wavy boundary.

Cg—48 to 80 inches; dark gray (10YR 4/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; about 5 percent pebbles; strong effervescence in the lower part; neutral in the upper part grading to moderately alkaline in the lower part.

The solum ranges from 40 to 60 inches in thickness. It is slightly acid or neutral. The content of coarse fragments ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is typically silty clay loam but is silt loam in some pedons. The Bt horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It is silty clay loam, silty clay, or clay. The content of clay in this horizon ranges from 35 to 50 percent. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or clay loam.

Upshur Series

The Upshur series consists of deep, well drained, slowly permeable soils formed in shale residuum on ridgetops and the upper part of side slopes in the uplands. Slope ranges from 8 to 25 percent.

Upshur soils are similar to Woodsfield soils and are commonly adjacent to Wellston, Westmore, and Zanesville soils. All of the similar and adjacent soils have less clay in the upper part of the subsoil than the Upshur soils. Also, Zanesville soils have a fragipan. The adjacent soils are in landscape positions similar to those of the Upshur soils.

Typical pedon of Upshur silty clay loam, 8 to 15 percent slopes, in Bearfield Township; 1,650 feet north and 1,800 feet west of the southeast corner of sec. 27, T. 13 N., R. 14 W.

Ap—0 to 7 inches; reddish brown (5YR 4/4) silty clay loam; weak medium granular structure; firm; common roots; brown (7.5YR 4/4) organic coatings on faces of peds; very strongly acid; abrupt smooth boundary.

Bt1—7 to 15 inches; red (2.5YR 4/6) clay; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; firm; few roots; many distinct dark red (2.5YR 3/6) clay films on faces of peds; very strongly acid; gradual wavy boundary.

Bt2—15 to 28 inches; red (10R 4/6) clay; moderate medium subangular blocky structure; firm; few roots; many distinct weak red (10R 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt3—28 to 35 inches; weak red (10R 4/4) clay; weak coarse subangular blocky structure; firm; few roots; common distinct dusky red (10R 3/3) clay films on faces of peds; neutral; gradual smooth boundary.

BC—35 to 42 inches; weak red (10R 4/4) silty clay; common medium distinct light olive brown (2.5Y 5/4) mottles; weak coarse subangular blocky structure; firm; few roots; few distinct dusky red (10R 3/3) clay films on faces of peds; slight effervescence; mildly alkaline; clear smooth boundary.

C—42 to 75 inches; variegated weak red (10R 4/4) and olive yellow (2.5Y 6/6) silty clay loam; massive; firm; few roots; about 5 percent soft shale; strong effervescence; moderately alkaline; clear smooth boundary.

Cr—75 to 80 inches; light olive brown (2.5Y 5/4), soft, weathered shale bedrock; common prominent reddish brown (2.5YR 4/4) clay films on shale fragments; few prominent light gray (10YR 7/2) silt coatings on shale fragments; strong effervescence; moderately alkaline.

The solum ranges from 26 to 50 inches in thickness. The depth to rippable, weathered shale bedrock ranges from 40 to 80 inches. The content of coarse fragments ranges from 0 to 10 percent in the solum. These fragments are mostly thin, flat pieces of shale and siltstone.

The Ap horizon has hue of 10YR to 5YR, value of 4, and chroma of 2 to 4. It is dominantly silty clay loam but is silt loam or silty clay in some pedons. Unless limed, it is medium acid to very strongly acid. The Bt horizon has hue of 5YR to 10R, value of 3 or 4, and chroma of 3 to 6. It is silty clay or clay. It is very strongly acid to slightly acid in the upper part and strongly acid to mildly alkaline in the lower part. The C horizon is dominantly silty clay loam, silty clay, or clay but is clay loam in some pedons. It is strongly acid to moderately alkaline.

Wellston Series

The Wellston series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying material weathered from siltstone and fine grained sandstone. Slope ranges from 1 to 15 percent.

Wellston soils are similar to Alford, Mentor, and Westmore soils and are commonly adjacent to Gilpin, Westmoreland, and Zanesville soils. Alford and Mentor soils have a lower content of coarse fragments in the lower part than the Wellston soils. Gilpin soils are moderately deep to bedrock. Gilpin and Westmoreland soils have a higher content of sand and coarse fragments in the subsoil than the Wellston soils. They are on side slopes and the narrower ridgetops. Westmore soils have more clay in the lower part than the Wellston soils. Zanesville soils are moderately well drained and are commonly on the plane or slightly convex parts of broad ridgetops. They have a fragipan.

Typical pedon of Wellston silt loam, 1 to 8 percent slopes, in Clayton Township; 2,500 feet north and 700 feet east of the southwest corner of sec. 2, T. 16 N., R. 15 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; friable; many roots; medium acid; abrupt smooth boundary.

Bt1—7 to 27 inches; brown (7.5YR 5/4) silt loam; moderate medium angular blocky structure; friable; common roots; common faint brown (7.5YR 4/4) clay films on faces of peds; few faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; strongly acid; abrupt smooth boundary.

2Bt2—27 to 34 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; firm; few roots; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; common distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 5 percent sandstone fragments; very strongly acid; clear smooth boundary.

2BC—34 to 47 inches; strong brown (7.5YR 5/6) loam; weak coarse subangular blocky structure; firm; few roots; few faint brown (7.5YR 5/4) clay films on faces of peds; common distinct light yellowish brown (10YR 6/4) and brown (10YR 5/3) silt coatings on faces of peds; about 3 percent sandstone fragments; strongly acid; clear smooth boundary.

2C—47 to 70 inches; strong brown (7.5YR 5/6) loam; common medium distinct brown (10YR 5/3) mottles; massive; friable; few black (10YR 2/1) concretions; about 10 percent soft sandstone fragments; strongly acid; abrupt wavy boundary.

2R—70 to 72 inches; hard sandstone bedrock.

The solum ranges from 32 to 50 inches in thickness. The depth to bedrock ranges from 40 to 72 inches. Unless limed, the soils are medium acid to very strongly acid throughout. The content of coarse fragments is less than 2 percent in the upper part of the solum, 2 to 10 percent in the lower part of the solum, and 5 to 60 percent in the 2C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The 2Bt horizon is silt loam, silty clay loam, loam, or clay loam. The 2C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, clay loam, sandy loam, or the channery or very channery analogs of these textures.

Westmore Series

The Westmore series consists of deep, well drained soils formed in loess and in the underlying material weathered from limestone, siltstone, and shale. These soils are on uplands. Permeability is moderate in the upper part of the profile and moderately slow or slow in the lower part. Slope ranges from 1 to 15 percent.

Westmore soils are similar to Alford, Mentor, and Wellston soils and are commonly adjacent to Guernsey and Westmoreland soils. Alford, Mentor, Wellston, and Westmoreland soils have less clay in the lower part than the Westmore soils. Guernsey and Westmoreland soils are in landscape positions similar to those of the Westmore soils. Guernsey soils are moderately well drained. They contain more clay in the upper part of the subsoil than the Westmore soils.

Typical pedon of Westmore silt loam, 8 to 15 percent slopes, in Bearfield Township; 400 feet north and 1,715 feet west of the southeast corner of sec. 1, T. 13 N., R. 14 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many roots; strongly acid; abrupt smooth boundary.

BE—8 to 11 inches; mixed yellowish brown (10YR 5/6) and brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; common roots; common faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt1—11 to 22 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; many distinct brown (7.5YR 5/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—22 to 26 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; few roots; many distinct brown (7.5YR 5/4) clay films and pale brown (10YR 6/3) silt coatings on faces of peds; few medium black (10YR 2/1) stains and concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

2Bt3—26 to 38 inches; yellowish brown (10YR 5/6) silty clay; few fine distinct strong brown (7.5YR 5/6) and brown (7.5YR 5/4) mottles; firm; few roots; few distinct grayish brown (10YR 5/2) clay films and few faint brown (10YR 5/3) silt coatings on faces of peds; strongly acid; gradual wavy boundary.

2Bt4—38 to 48 inches; strong brown (7.5YR 5/6) silty clay; moderate medium and coarse subangular blocky structure; firm; common distinct brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

2BC—48 to 59 inches; brown (7.5YR 5/4) silty clay; weak coarse subangular blocky structure; firm; few faint clay films on faces of peds; few medium black (10YR 2/1) stains and concretions (iron and manganese oxides); about 2 percent soft siltstone fragments; strongly acid; abrupt smooth boundary.

2C—59 to 70 inches; light brownish gray (2.5Y 6/2) channery silty clay; massive; firm; common light olive brown (2.5Y 5/4) and very dark grayish brown (2.5Y 3/2) stains; about 15 percent siltstone fragments; slightly acid; abrupt wavy boundary.

2R—70 to 75 inches; hard, olive brown (2.5Y 4/4) siltstone bedrock.

The thickness of the solum ranges from 40 to more than 60 inches. The depth to bedrock ranges from 48 to more than 72 inches. The silty mantle is 20 to 36 inches thick. The content of coarse fragments is less than 5 percent in the A, Bt, and 2Bt horizons and ranges from 5 to 20 percent in the 2C horizon. Most of the coarse fragments are thin, flat pieces of siltstone. Unless the soils are limed, the solum is very strongly acid to medium acid. The C horizon is medium acid to mildly alkaline.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. Pedons in wooded areas have an A horizon. This horizon is as much as 5 inches thick. It has value of 2 to 4 and chroma of 1 to 3. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam, silty clay, or clay. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is clay, silty clay, silty clay loam, clay loam, or the channery analogs of these textures.

Westmoreland Series

The Westmoreland series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in residuum and colluvium derived from siltstone, fine and medium grained sandstone, and thinly bedded, nonacid shale. Slope ranges from 8 to 70 percent.

Westmoreland soils are similar to Gilpin soils and are commonly adjacent to Guernsey, Wellston, and Westmore soils. Gilpin soils are moderately deep to bedrock. Guernsey soils are moderately well drained. They contain more clay in the subsoil than the Westmoreland soils. They occur as areas intermingled with areas of the Westmoreland soils on ridgetops and side slopes. Wellston and Westmore soils are mainly on ridgetops. They have a higher content of silt and a lower content of sand and coarse fragments in the upper part of the subsoil than the Westmoreland soils. Also, Westmore soils have more clay in the lower part of the subsoil.

Typical pedon of Westmoreland silt loam, in an area of Guernsey-Westmoreland silt loams, 25 to 40 percent slopes, in Coal Township; 3,160 feet west and 2,040 feet south of the northeast corner of sec. 26, T. 14 N., R. 15 W.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; very friable; many roots; about 5 percent coarse fragments; slightly acid; abrupt wavy boundary.

E—2 to 5 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; many roots; about 5 percent coarse fragments; medium acid; clear wavy boundary.

BE—5 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak coarse and medium subangular blocky structure; friable; common roots; brown (10YR 4/3) coatings on faces of peds; about 5 percent coarse fragments; strongly acid; gradual smooth boundary.

Bt1—11 to 16 inches; brown (7.5YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—16 to 23 inches; brown (7.5YR 5/4) silt loam; moderate fine and medium subangular blocky structure; friable; few roots; many distinct brown (7.5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt3—23 to 30 inches; brown (7.5YR 5/4) channery silt loam; moderate medium subangular blocky structure; firm; few roots; many distinct brown (7.5YR 4/4) clay films on faces of peds; about 25 percent coarse fragments; very strongly acid; clear wavy boundary.

BC—30 to 38 inches; brown (7.5YR 5/4) very channery silt loam; weak coarse subangular blocky structure; firm; few roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; about 45 percent coarse fragments; strongly acid; clear wavy boundary.

C—38 to 43 inches; yellowish brown (10YR 5/4) very channery silt loam; massive; firm; few roots; about 45 percent coarse fragments; very strongly acid; abrupt smooth boundary.

R—43 to 45 inches; hard, olive brown (2.5Y 4/4) siltstone bedrock.

The solum ranges from 20 to 40 inches in thickness. The depth to bedrock ranges from 40 to more than 72 inches. The content of coarse fragments ranges from 2 to 20 percent in the A horizon, from 2 to 30 percent in the Bt horizon, from 5 to 70 percent in the BC horizon, and from 45 to 90 percent in the C horizon. The coarse fragments are mostly thin, flat pieces of sandstone and siltstone less than 10 inches long. Unless limed, the soils are medium acid to very strongly acid throughout.

The A horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. Its fine-earth fraction is silt loam, silty clay loam, loam, or clay loam. The C horizon has colors and fine-earth textures similar to those of the Bt horizon.

Woodsfield Series

The Woodsfield series consists of deep, well drained soils formed in loess and in the underlying material weathered from reddish clay shale and thinly bedded siltstone. These soils are on uplands. Permeability is moderate in the upper part of the profile and moderately slow or slow in the lower part. Slope ranges from 8 to 15 percent.

Woodsfield soils are similar to Upshur soils and are commonly adjacent to Wellston, Westmore, and Zanesville soils. Upshur soils have more clay in the upper part of the subsoil than the Woodsfield soils.

Wellston, Westmore, and Zanesville soils are in landscape positions similar to those of the Woodsfield soils. Wellston and Zanesville soils have less clay in the lower part of the subsoil than the Woodsfield soils. Westmore soils have a yellower hue in the lower part of the subsoil than the Woodsfield soils.

Typical pedon of Woodsfield silt loam, 8 to 15 percent slopes, in Monroe Township; 520 feet east and 1,720 feet north of the southwest corner of sec. 13, T. 12 N., R. 14 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; grading to brown (10YR 4/3) in the lower part; weak medium granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

BE—8 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; common roots; very strongly acid; clear smooth boundary.

Bt1—11 to 18 inches; brown (7.5YR 5/4) silt loam; moderate fine and medium subangular blocky structure; friable; common roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—18 to 21 inches; brown (7.5YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; common roots; common distinct reddish brown (5YR 4/4) clay films on faces of peds; few faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; very strongly acid; abrupt smooth boundary.

2Bt3—21 to 34 inches; dark red (2.5YR 3/6) clay; moderate medium angular blocky structure; firm; few roots; many distinct reddish brown (2.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt4—34 to 42 inches; dark reddish brown (2.5YR 3/4) clay; few fine distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; few roots; common distinct reddish brown (2.5YR 4/4) clay films on faces of peds; few concretions (oxide); medium acid; gradual smooth boundary.

2Bt5—42 to 47 inches; reddish brown (5YR 4/4) clay; weak coarse subangular blocky structure; firm; few roots; common faint reddish brown (2.5YR 4/4) clay films on faces of peds; about 5 percent grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/6) fragments; few concretions (oxide); neutral; clear wavy boundary.

2C—47 to 51 inches; grayish brown (2.5Y 5/2) silty clay loam; massive; firm; few distinct reddish brown (5YR 4/4) clay films on coarse fragments; about 10 percent soft gray (10YR 5/1) shale and strong brown (7.5YR 5/8) siltstone fragments; strong effervescence; mildly alkaline; clear smooth boundary.

2Cr—51 to 80 inches; grayish brown (2.5Y 5/2), soft shale; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock ranges from 45 to 72 inches. The silty mantle is 14 to 26 inches thick. Unless the soils are limed, reaction is strongly acid or very strongly acid in the upper part of the solum, strongly acid to mildly alkaline in the lower part of the solum, and medium acid to mildly alkaline in the C horizon. The content of coarse fragments ranges from 0 to 15 percent in the solum. These fragments are mostly thin, flat pieces of soft shale and siltstone.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 5YR to 10YR, 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 5YR to 10R, value of 3 to 5, and chroma of 3 to 6. It is silty clay loam, silty clay, or clay.

Zanesville Series

The Zanesville series consists of deep, moderately well drained soils formed in loess and in the underlying sandstone and siltstone residuum. These soils are on uplands. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Slope ranges from 1 to 15 percent.

Zanesville soils are similar to Cincinnati soils and are commonly adjacent to Gilpin, Guernsey, Wellston, and Westmoreland soils. Cincinnati soils have rounded glacial pebbles in the lower part of the subsoil. Gilpin, Guernsey, Wellston, and Westmoreland soils do not have a fragipan. Gilpin, Guernsey, and Westmoreland soils are commonly on side slopes and ridgetops, and Wellston soils are on ridgetops.

Typical pedon of Zanesville silt loam, 1 to 8 percent slopes, in Monroe Township; 880 feet north and 200 feet east of the southwest corner of sec. 23, T. 12 N., R. 14 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine and medium granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

BA—6 to 11 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; common roots; brown (10YR 4/3) organic coatings on faces of some peds; very strongly acid; gradual smooth boundary.

Bt1—11 to 23 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; few roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—23 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct grayish brown

(10YR 5/2) mottles; moderate fine and medium subangular blocky structure; friable; few roots; common distinct brown (10YR 4/4) clay films on faces of peds; few black (10YR 2/1) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Btx—27 to 47 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to weak medium platy and weak fine subangular blocky; very firm; brittle; few roots; many distinct grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) clay films on faces of prisms; common black (10YR 2/1) concretions (iron and manganese oxides); about 2 percent siltstone fragments; very strongly acid; clear smooth boundary.

2BC—47 to 61 inches; light yellowish brown (10YR 6/4) channery clay loam; few fine distinct gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few distinct grayish brown (10YR 5/2) clay films on faces of some peds; few black concretions (iron and manganese oxides); about 15 percent siltstone fragments; very strongly acid; abrupt smooth boundary.

2C—61 to 75 inches; strong brown (7.5YR 5/6) channery clay loam; few fine prominent gray (10YR 6/1) mottles; massive; firm; common black (10YR 2/1) concretions (iron and manganese oxides); about 15 percent siltstone and shale fragments; very strongly acid; clear smooth boundary.

2R—75 to 80 inches; hard, olive brown (2.5Y 4/4) siltstone bedrock.

The thickness of the solum ranges from 40 to 70 inches. The depth to the top of the fragipan is 24 to 32 inches, and the depth to bedrock ranges from 40 to 80 inches. Unless limed, the soils are strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 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 6. It is silt loam or silty clay loam. The Btx horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The 2C horizon has colors similar to those of the Btx horizon. It is silty clay loam, clay loam, silt loam, loam, or the channery analogs of these textures.

Formation of the Soils

This section describes how the major factors of soil formation have affected the soils in Perry County and explains some of the processes of soil formation.

Factors of Soil Formation

Soils form through processes acting on deposited or accumulated geologic material. The major factors of soil formation are parent material, climate, relief, living organisms, and time.

Climate and living organisms, particularly vegetation, are the active forces in 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. 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 Perry County formed in several kinds of parent material: residuum, colluvium, glacial till, glacial outwash, alluvium, lacustrine sediments, loess, or a combination of these.

Bedrock residuum is the most extensive parent material in the county. The upland soils on ridgetops and the upper side slopes in the unglaciated part of the county formed in residuum.

Limestone and shale residuum is moderately fine textured or fine textured. The soils that formed in this material, such as Guernsey and Upshur, have a moderately fine textured or fine textured subsoil. Material weathered from siltstone and fine grained sandstone is medium textured. The soils that formed in this material have a medium textured or moderately fine textured subsoil. Examples are Brownsville, Gilpin, and Westmoreland soils (*9*). Soils that formed in material weathered from medium or coarse grained sandstone have a medium textured to coarse textured subsoil. Dekalb soils are an example.

In some areas the upper part of the soil formed in loess (*11*). In these areas the loess cap is as much as 48 inches deep over residuum. Wellston, Westmore, Woodsfield, and Zanesville are the principal soils that are partially capped by loess. On some of the wider ridgetops, on some benches, and in some covelike areas, the loess mantle is 48 to more than 72 inches thick. Alford soils formed in these thicker deposits of loess.

Colluvium is weathered bedrock and soil material that has been moved downhill. The soils on the steeper, middle, and lower parts of hillsides show the effects of colluvial action. These soils formed in residuum and colluvium. They are deeper on the lower and more concave parts of slopes because of the downslope movement resulting from gravity, water action, animal activity, and frost action over long periods.

Coal has been surfaced mined in the county since the 1940's. Most mined areas are unreclaimed. They occur as ungraded spoil ridges. Bethesda, Enoch, and Fairpoint soils formed in a mixture of broken bedrock and partly weathered fine earth in surface-mined areas.

Both the Illinoian and Wisconsinan ice sheets invaded Perry County. The Illinoian ice covered most of the northern and western parts of the county. It left thin deposits of glacial till on most ridgetops and scattered, generally thicker deposits of till on some side slopes and in valleys. Cincinnati and Homewood soils formed in Illinoian glacial till and in a loess cap less than 40 inches thick. The later advance of Wisconsinan ice covered the Thorn Township area. It left thicker deposits of glacial till and had a more leveling effect on the landscape. Amanda, Centerburg, Bennington, and Pewamo soils formed in Wisconsinan glacial till.

Glacial outwash was deposited along Jonathan Creek. Terraces formed in this area. This fairly well sorted, coarse textured outwash was covered by loamy outwash or silty sediments. Ockley and Mentor soils formed in these materials.

Lacustrine sediments are on terraces along the major streams in the county. Most strata of these sediments are silty. The soils that formed in them have a dominantly silty subsoil. Examples are Glenford, Fitchville, Luray, and Peoga soils.

Recent alluvium on flood plains is the youngest parent material in the county. It is still accumulating as fresh sediment is added during the overflow of streams. Killbuck, Newark, and Nolin soils formed in this material.

Climate

Because the climate in Perry County is uniform, it has not greatly contributed to differences among the soils. It has favored both physical change and chemical weathering of parent material and the activity of living organisms.

Rainfall has been adequate to leach from the subsoil any carbonates that were in the parent material of many upland and terrace soils. Brownsville, Gilpin, and Dekalb soils have a strongly acid to extremely acid subsoil and have less than 60 percent base saturation. Wetting and drying cycles have favored the translocation of clay minerals and the formation of soil structure common in most of the soils in the county.

The range of temperature variation has favored both physical change and chemical weathering of the parent material. Freezing and thawing aided the formation of soil structure. Warm temperatures in the summer favored chemical reactions in the weathering of primary material.

More information about the climate is available in the section "General Nature of the County."

Relief

Relief affects the natural drainage of soils through its effect on the amount of runoff and the depth to a seasonal high water table. Water that runs off the more sloping soils collects in depressions or is removed through a drainage system. From an equal amount of rainfall, the more sloping soils receive less water than depressional or nearly level soils. Gently sloping soils generally show the most evidence of profile development because they are neither saturated nor droughty. Soil formation on steep slopes tends to be inhibited by erosion and runoff.

Relief can account for the formation of different soils from the same kind of parent material. For example, Glenford and Luray soils both formed in lacustrine sediments. The moderately well drained Glenford soils are on the higher, more sloping parts of terraces and in old glacial lake basins. Their seasonal high water table generally is not close to the surface. The very poorly drained, nearly level Luray soils are in the lower areas. Their seasonal high water table is near or above the surface.

Living Organisms

Plants, animals, bacteria, fungi, and other living organisms affect soil formation. At the time that the county was settled, the vegetation was dominantly hardwood forest of beech, maple, oak, yellow-poplar, and ash. The soils that formed in these forested areas are generally acid and are moderate or low in natural fertility.

Small animals, insects, earthworms, and burrowing animals leave channels in the soil and make it more permeable. Animals also mix the soil material and contribute organic matter. Worm channels or worm casts are most common in the surface layer of soils that have been limed or in soils on flood plains, such as Nolin. Crawfish channels are evident in the poorly drained and somewhat poorly drained soils.

Human activities also affect soil formation. Examples of these activities are plowing, seeding, installing drainage systems, irrigating, cutting and filling, and surface mining. Another example is the application of lime and fertilizer, which neutralizes an acid soil and adds bases.

Time

Time is needed for the other factors of soil formation to produce their effects. The age of a soil is indicated, to some extent, by the degree of profile development. In many places factors other than time have been responsible for most of the differences in the kind and distinctness of layers among different soils. If the parent material weathers slowly, the soil forms slowly.

Most of the soils in the county are old and have distinct horizons and well expressed structure. On flood plains deposition of fresh sediments periodically interrupts soil formation. Nolin and Newark soils, which are on flood plains, do not have a strongly expressed profile.

Processes of Soil Formation

Most of the soils in Perry County have a strongly expressed profile because the processes of soil formation have distinctly changed the parent material. These are the upland soils on ridgetops and side slopes and the soils on terraces along the major streams. In contrast, the soils on flood plains and in surface-mined areas have been only slightly modified by the processes of soil formation.

All the factors of soil formation help to control the processes that form different layers in the soil. These processes are additions, removals, transfers, and transformations. Some processes result in differences among the surface layer, subsoil, and substratum, whereas others retard horizon differentiation or obliterate existing differences.

In this county the most important addition to the soil is that of organic matter to the surface layer. A thin layer of organic matter accumulates under woody vegetation. If the soil is cleared and cultivated, this organic matter is mixed with underlying mineral material. In severely eroded soils, all evidence of this addition has been removed.

Leaching of carbonates from calcareous parent material is one of the most significant removals. It precedes many other chemical changes in the soil. Limestone and limy shale in undisturbed soils and the combination of these materials in surface-mined soils have a high content of carbonates when first exposed to leaching. Most of the other soils on uplands and terraces do not have carbonates within 60 inches of the surface and are medium acid to extremely acid in the subsoil.

Other minerals in the soil are subject to the chemical weathering that results from leaching, but their resistance is higher and their removal is slower. Following the removal of carbonates, alteration of such minerals as biotite and feldspar results in color changes in the subsoil. Free iron oxides are produced. If they are segregated by a fluctuating high water table, they can result in gray colors and in mottles in some soils, such as Bennington, Euclid, Luray, and Newark soils. Unless the water table is seasonally high because of a fragipan or other restricting layer, brownish colors are typical in most of the soils in the county.

Seasonal wetting and drying of 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 particles are suspended in the percolating water moving through the surface layer and are then deposited in the subsoil. This transfer of fine clay accounts for the faint or distinct clay films on the faces of peds in the subsoil of most soils on uplands and terraces.

Transformations of mineral compounds occur in most soils. The results 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. As this weathering occurs, secondary minerals, mainly layer lattice silicate clays, are produced. Most of the layer lattice clays remain in the subsoil.

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Glossary

Aeration sewage disposal system. A disposal system in which the decomposition of sewage is achieved through oxidation. The sewage is exposed to air for a period long enough to result in adequate treatment.

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.

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—

	Inches
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.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

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.

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.

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.

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.

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.

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.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

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.

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.

Highwall. The unexcavated face of exposed overburden and coal in a surface mine or the face or bank on the uphill side of a contour strip-mine excavation.

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.

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

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.

Outslope. The exposed area sloping away from a bench cut section in strip mines.

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 drain. 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.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

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.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

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 is expressed as—

	pH
Ultra acid	below 3.6
Extremely acid	3.6 to 4.4
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.

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.

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.

Slack-water deposit (geologic). Material that was deposited in still water and was subsequently exposed when the water level was lowered or when the elevation of the land was raised.

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 of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, 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.

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 wind 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).

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, AC, 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, AC, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

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.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

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 melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

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 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 sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.